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NEW LOOK ea!

EGAPIXEL MADNESS
m Moffat concludes
s hands-on report
the C2000-Z

RBLOCK
mple security
r your home
shop

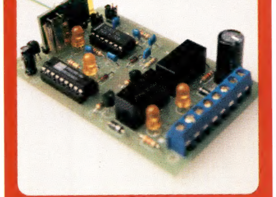
BOOM!

SURROUND SOUND: WHAT'S IT ALL ABOUT?

PAGE 40

Olympus C-2000 digital camera

PAGE 70



2-4 channel UHF Remote Control

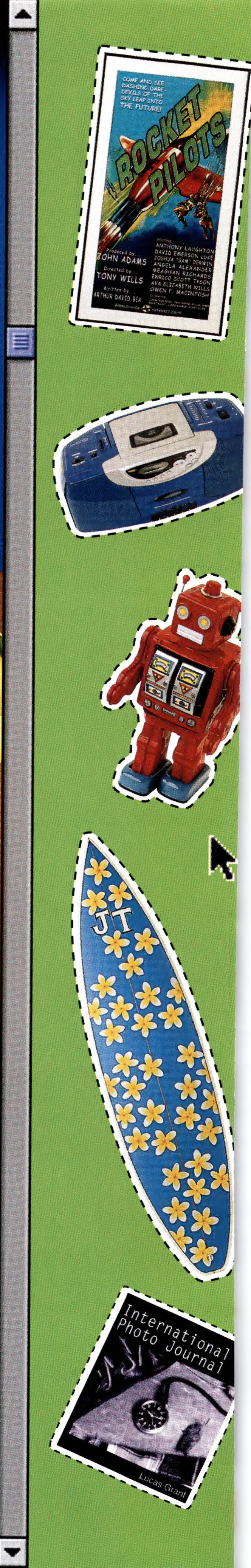
PAGE 20

All the facts on Surround Sound

REVIEWED INSIDE
- Short circuits
- Onkyo surround sound decoder

BUILD 2-4 Channel UHF remote control, weekly timer

PLUS: Experimenting with electronics, Vintage radio, $10 Wonders and Agilent's new 54600-series scopes



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ELECTRONICS AUSTRALIA MAGAZINE **VOL. 62, NO. 5**
MAY 2000

FEATURES

18 Onkyo Surround Sound Decoder

The Onkyo ED-301 processor is a great alternative to a full bells-and-whistles digital surround amp or receiver.

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Denon's AVC-A10SE might be a tad expensive, but its performance is very impressive.

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Solid, with strong performance.

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We reward you for subscribing - really!

WHAT'S NEW

IN THE EVER CHANGING WORLD OF ELECTRONICS

THIS MONTH

Ericsson iPhone Internet telephone

Philips' new space-saving monitors

Swatch Twinphones from Dick Smith Electronics

JVC UX-G6 MOSFET mini system

Tektronix Phaser 850 solid-ink colour printer

IBM's NetVista Legacy-Free PC

Hitachi's CP-X940 lightweight projector

Hitachi DVD-RAM camcorder

EPSON STYLUS PHOTO 1270 & non fade prints

Freeplay self-powered torch

Electro-Harmonix 6V6EH 'super tube'

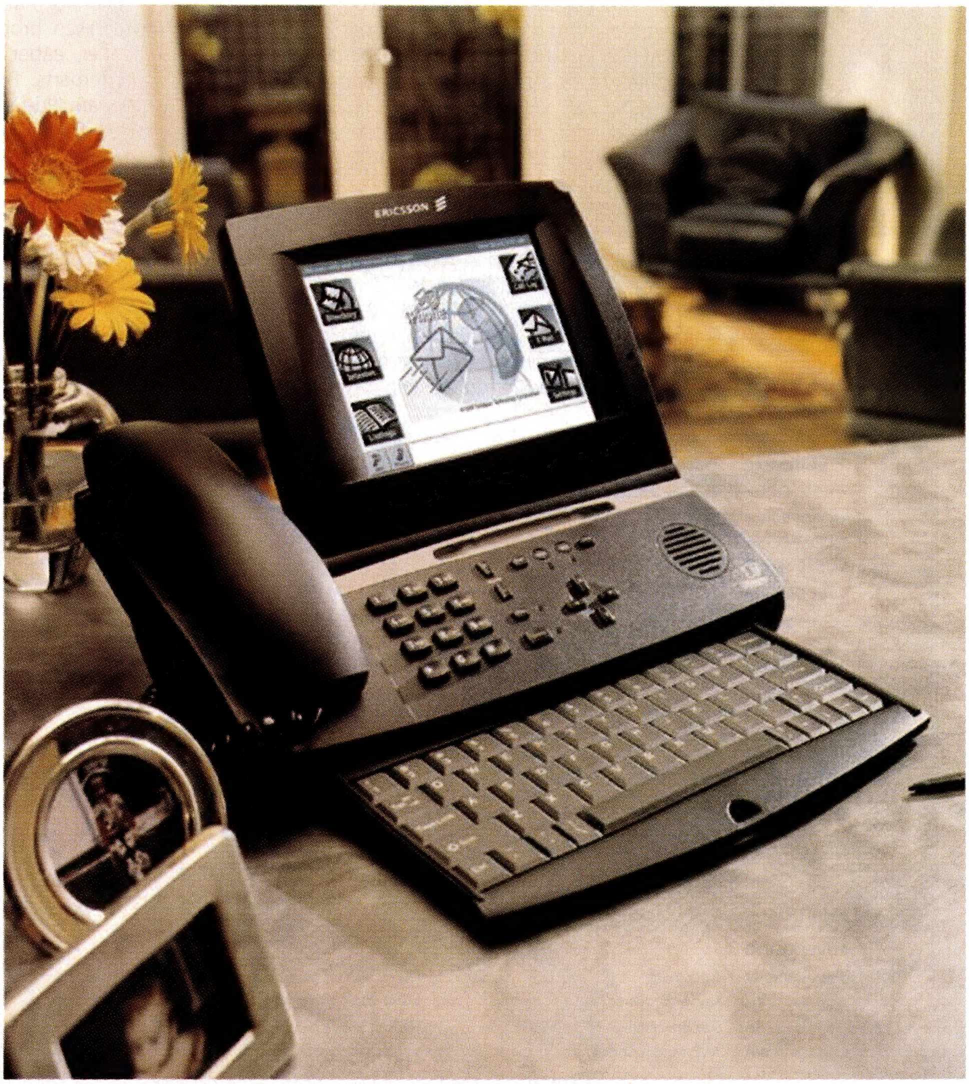
Sovtek 12AX7LPS 'large plate' valve

Marantz DR-17 'high end' CD-Recorder

Diamond Rio and Creative Nomad MP3 players

Dick Smith Electronics' Liberator cat collar

JVC XV-M555B 3-disk DVD changer



I spy an — iPhone

YOU CAN NOW look forward to an all-in-one telephone with email and Internet access with the latest introduction of the Ericsson iPhone.

The iPhone combines an advanced Internet telephone appliance with a touch screen, a laptop-sized keyboard and a 56Kbps modem that quickly and easily allows users to communicate by phone or by e-mail. Users can browse the Web, conduct electronic transactions such as online shopping, access online white pages and yellow pages, read up to the minute news and sports scores, check stock quotes, and book movie and theatre tickets.

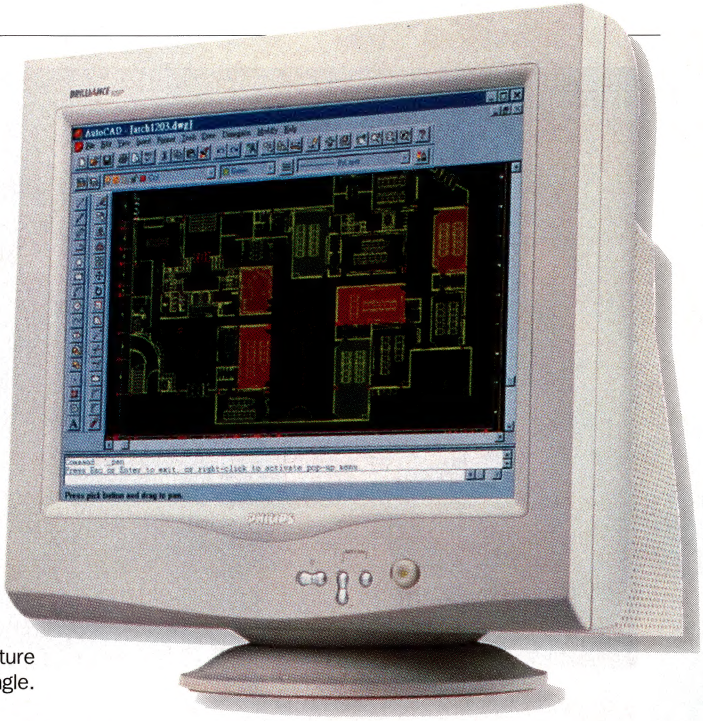
The iPhone's advanced telephone features will enable users to save names, street addresses, phone numbers, and email addresses using the iPhone Directory — then call or email using the touch screen, as well as find out who has called using the iPhone's Caller ID and Caller Log.

The Ericsson iPhone supports all Telstra's telephony features, including Call Forwarding,

Voicemail and Conference Calling which enable users to call forward their business phone to their mobiles, access voicemails from a remote location, and conference call their families to make weekend arrangements — all at the touch of a button.

The Ericsson iPhone is currently retailing at Strathfield stores in Australia at $899, but will also be available at many more retail outlets in the near future. The Ericsson iPhone is also available to purchase online at **www.iPhone.com.au**.

15% less monitor for your money



PHILIPS HAVE ANNOUNCED the release of its new range of monitors for 2000, with the pledge that PC users can "reclaim their desk space", thanks to an innovative wedge shaped space-saving design.

Conventional cathode ray tube (CRT) monitors are large and bulky due to the size of the circuit board inside, To counter this, Philips has re-configured its circuitry to accommodate a more compact chassis. The result is a dramatic reduction in the overall size, and a CRT monitor range with one of the smallest footprints in each class.

The new wedge shape design features a slim rear panel that allows the monitor to be placed further into a corner than a conventional monitor of the same screen size. Across the range, the monitors take up 15% less desk space on average.

As well as the conventional CRT range, there are new 15" and 18" LCD monitors available, boasting small footprint, outstanding picture quality, intelligent display features and 160 degree wide viewing angle. Contact your nearest Philips dealer for details.

'Funky' Twinphones from DSE

TELEPHONE CONVERSATIONS getting boring? Dick Smith Electronics has released a new range of twin handset Swatch telephones in a range of bright colours, to liven things up a bit. Created by Swatch, the Swiss watch makers, these phones are said to be the latest in telephone technology.

The Swatch Twinphone comes in three different colours - Tequila Sunset, (raspberry red and citrus orange); Blue Moon, (ultramarine blue); and Limelite, (Lime Green and Ultramarine Blue). As is all the rage now, the coloured casing of the phones is translucent, allowing for all the inner workings and mechanics of the phone to be seen.

The Twinphone concept is unique to Swatch. The base of the telephone doubles as a second handset, allowing for a three way conversation between friends. When the base handset is not in use, it can be put on mute so that only the main handset is in operation.

With three direct dial keys, ten speed dial memories and an LCD display that shows the duration of the phone call, the Twinphone is simple and easy to use.

The Swatch Twinphone is available from Dick Smith Electronics PowerHouse stores for a retail price of $139. The Swatch Twinphone is also available via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644 or visiting their website at **www.dse.com.au**.

Micro with MOSFETs

JVC HAS RELEASED a new micro component system with a difference. Rare for a system in this class, the UX-G6 features a MOSFET amplifier in discrete configuration. MOSFETs combine higher linearity, better thermal stability and lower drive currents than common bipolar transistors. The use of MOSFETs, moreover, greatly simplifies circuit configurations, making it possible to remove the drive stage.

All its components — amp, CD/tuner, cassette deck — are separate, so you can lay them and the pair of speakers out the way you like. The sliding control panel is a novel approach and easy to use. At a touch, the motor-driven control panel slides down to make keys and controls accessible to fingertip control. Another touch of the button pulls up the panel to make the overall look neat and clean.

The CD player features a one-bit converter for superior frequency and phase responses, high signal-to-to-noise ratio, and accurate, high-resolution sound. Playback features include a 32-track programme, plus random and repeat play. There's an optical digital output for digital-to-digital dubbing, and a cassette deck equipped with Dolby B noise reduction.

Its speaker systems come with a 'balanced design' cone tweeter that distributes the mass equally between the centre cap and cone relative to the voice coil, for low distortion and flat frequency response. The linear phase speaker alignment positions the voice coil of the woofer vertically in line with that of the tweeter, so that the sounds from both speakers reach the listener at the same instant, to ensure sharp sound imaging. Also, the MDF enclosure helps the speaker deliver tight, crisp sound.

WHAT'S NEW

IN THE EVER CHANGING WORLD OF ELECTRONICS

Free light!

THE FREEPLAY self-powered torch available from Dick Smith Electronics utilises the power of its user to generate and store energy.

The user rotates the winding handle for approximately 30 seconds, which energises a special constant force spring. Power is generated by the rotational force of the spring driving a generator through an internal gear train. When the torch is fully charged, it will shine for up to two hours.

The Freeplay torch can also be charged using an AC/DC adaptor (with 12 volt output) or a 12 volt car charger (not supplied).

Although it takes only 30 seconds to wind, it can also be stored in the fully wound state, ready for immediate use.

If more than two hours shine time is required, the torch can be charged repeatedly through the winding handle. Power from successive winds will be converted to electrical energy and stored. To ensure constant bright light, the Freeplay self-powered torch is equipped with a high efficiency Xenon bulb with a spare bulb included.

The self-powered torch can also be used to power other low power consumption items like portable radios via the three volt output socket. For emergency situations, the product has a flashing mode.

The Freeplay self-powered torch is made of durable ABS plastic and comes in two different colours, translucent blue and yellow. The torch is also weather resistant and comes with a five year warranty.

The Freeplay self-powered torch is available from Dick Smith Electronics Powerhouse stores located in Bankstown and Penrith in NSW and Carnegie in Victoria for a recommended retail price of $99.80 or via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644.

* * *

The ultimate CD-R?

MARANTZ IS AGAIN sets the benchmark in superior home audio with the release in Australia of its "reference" CD-Recorder, the DR-17. It is unashamedly 'high end' and has a recommended retail price of $3290, but the DR-17 also carries the mantle of perhaps the most sophisticated and complete CD-Recorder currently available.

As a stand-alone component of Marantz's Premium Series, the DR-17 redefines quality in both the playback and recording of digital music. It will record and playback either CD-R (record-once) discs or the more recently introduced record/erase CR-RW (rewritable) discs and can handle input rates of 32, 44 and 48kHz, making it compatible with most digital sources (including DAT and MiniDisc). It is also one of the first CD recorders to feature HDCD (high definition CD) copy and playback capability.

For further information on this or any other Marantz product contact Jamo Australia on (03) 9543 1533 or visit the Marantz web site at ***www.marantz.com****.*

Try a 6V6EH 'super tube'

IMPROVE THE TONE of your 6V6 equipped vintage Ampeg, Fender, Gibson, Magnatone, Silvertone or Supro amp with the newest addition to the line of Electro-Harmonix premium vacuum tubes — the 6V6EH. The new 6V6EH has characteristics and qualities that equal and even surpass new old stock USA, JAN, Philips and rare RCA tubes.

In the past, vintage amp owners have had to deal with tube wear and failure caused by amp voltages that exceeded the tolerance level of most available 6V6 tubes. Now you can install a set of Electro-Harmonix 6V6EH's without worry. Each new 6V6EH is performance tested at up to 475 Volts.

In addition, each 6V6EH is constructed using specially developed cathode coating, 6550 grade tri-alloy plate material and careful alignment of the grids. The result is a 'Super Tube' with vastly increased reliability, lower odd harmonics and a sweeter tone.

There has never been a 6V6 like the Electro-Harmonix 6V6EH — apparently... For more information contact Electro-Harmonix at info@ehx.com, or visit their valve-powered web-site at ***www.ehx.com***

Or perhaps a 12AX7LPS

THE "LP" IN SOVTEK 12AX7LPS stands for 'large plate'. Large plate design is modelled after classic 12AX7's like the Telefunkens and Mullards. The greater size of the plate results in smoother, more linear performance, emphasising pleasing second-degree harmonics. The "S" stands for "spiral filament". Twisting the filament into a spiral reduces leakage between the filament and the cathode, lowering the noise that can be created by AC heaters in vintage stereo and guitar amplifiers as well as modern reissues by Macintosh, VTL, Marantz and Fender.

DC heated amplifiers are also improved since the spiral filament helps counteract the noise inherent in any large plate 12AX7, without sacrificing the tone that the increased plate size provides.

It all boils down to that old ideal: high gain, with low distortion and low noise. For more information visit ***www.sovtek.com****.*

Revved up Rio

WITH THE EVER increasing popularity of the Internet, the number of MP3 files being downloaded from the web is growing daily. In response to this trend Dick Smith Electronics PowerHouse stores now have a number of portable MP3 players in the range.

MP3 files can be downloaded on to a PC and played on the computer using software if a sound card is installed, or they can be downloaded onto a portable MP3 player connected to the PC via a parallel or USB port.

PowerHouse stores have three of these players - two Diamond Rio models and one Creative Nomad model. All three models look very much like a personal stereo or Walkman and store MP3 files in memory to be replayed by the user.

The Diamond Rio 3000 has 32 megabytes of built-in flash memory and connects to a PC via a parallel cable. It has a retail price of $349. The Diamond Rio 500 has double the memory with 64 megabytes, and connects to the PC via a USB connection. It has a retail price of $599.

The Creative Nomad MP3 Stereo also has 64 megabytes of memory (32 megabytes on board and 32 megabytes on smart media) and a built-in FM tuner. It connects to the PC via a parallel port and has a retail price of $599.

The MP3 players are available from Dick Smith Electronics PowerHouse stores in Penrith, Bankstown and Moore Park in NSW and Carnegie and Nunawading in Victoria. They can also be purchased via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644 or by visiting the website at ***www.dse.com.au.***

Klever Kitty Kollar

YOU SHUFFLE INTO the kitchen one morning wanting only coffee and a bowl of Weeties, and what do you find? Your cat presenting you with a dead bilby. Oh,dear. What to do?

You can't teach cats that to kill native wildlife is wrong — they wouldn't know the difference between a rat and a marsupial mouse, or a Crimson Rosella for that matter.

So the answer could be to prevent them from killing at all by warning the impending victim of the terror cat's approach.

Now the traditional bell is all very well but just think how maddeningly annoying that must be to live with, for the cat as well as the human.

Enter the new Liberator Cat Collar Alarm from Dick Smith Electronics. This electronic cat collar alerts birds and small animals of an impending cat attack, by sound and flashing light.

When a cat wearing the Liberator Collar Alarm goes into attack mode, a motion sensor is triggered sounding the alarm at the beginning of, and during, the entire strike.

The cat collar alarm is audible to human ears, but quiet enough not to offend the cat, while being loud enough to deliver a pre-attack warning. By sounding off the alarm, the Liberator effectively sabotages the 'strike action' without placing any physical or physiological restrictions on the cat. Although what it does for Kitty's pride is anybody's guess...

The Liberator Cat Collar is lightweight and comfortable for cats and can be adjusted for different sizes. Along with a twelve-month guarantee, the Liberator Cat Collar Alarm is fitted with a replaceable longlife battery and is endorsed by the Australian Wildlife Protection Council.

Keep Kitty under control for only $24.95 from your local Dick Smith Electronics store.

3-disc DVD changer

JVC'S NEWEST DVD PLAYER, the romantically-named XV-M555BK 3-Disc DVD & CD Changer, features 3 independent trays with play exchange, allowing users to change discs while another is playing. It allows one component to handle both DVDs and CDs easily, so you can leave your favourite music CD's loaded, and easily insert a DVD to watch without removing all discs.

The XV-M555BK's impressive video starts with a 10-bit/27MHz D/A converter while the audio stems from 24bit/96kHz Audio D/A Converter, with a dynamic range of 106dB. Digital Out for AC3 and DTS lets you configure the audio to match your home theatre system.

High-tech features of the XV-M555BK 3-Disc Changer include a new GUI (graphical user interface) for easy control, plus built-in functions like variable search, variable slow, resume, digest, strobe and zoom (4x). The XV-M555BK 3-Disc Changer features three on-screen languages (English, French and German), and is currently available for $899.00 RRP.

For more information on JVC's XV-M555BK or other JVC products, visit JVC's web site at ***www.ivc-australia.com.*** ■

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Letters to the Editor

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

All contributions to EA will be considered for publication in this column

Digital Dictation

Thanks again for a great mag. I read with interest your review of the Sanyo ICR-B100, which is described as "...a unique, hand-held Digital Dictating Machine". Sorry, but Olympus have had their DS-150 on the market for some time.

I bought mine a couple of months ago. It has up to 180 minutes of recording time, otherwise its attributes seem to be exactly the same as the Sanyo, including PC interface cable, software and use of IBM ViaVoice. I dictated this email with it.

Oh yes, and it's around half the price — under $500 (from Officeworks).

Michael Ingall, (via email)

April fool?

I have been a subscriber to Electronics Australia for many years, and although my eyesight is not as good as it was (I am 86 years of age), I still find no difficulty in reading it.

That is until you started printing parts of it on a dark coloured background, thus reducing the contrast. In the March issue, pages 16 and 17 are very difficult, 21 not quite so bad, 26 impossible. If you must use dark backgrounds, then use white print as on page 84. But why use dark backgrounds at all, when they only make it more difficult to read and don't add anything?

As for the change in name, why? I'm sure you will lose readers who would otherwise pick it up in newsagents and people indexing and classifying periodicals will find it much more difficult. Isn't it a change for the sake of change or is it an April fool's joke?

Ray Crooks B.Sc, Hervey Bay, Qld.

The Internot

Yesterday, I was able (for the first time) to get access to a computer that had Internet access. I had just 30 minutes on the machine so, armed with a list of web sites taken from respected publications (like 'EA') I began typing in the addresses.

Every site, except one, was either 'closed', 'restricted' (why?), 'moved address' or 'not available via this server'. Finally, the very last address I typed in produced a title page which just sat there for the next five minutes. No amount of button-pushing would let me see what was on the rest of the site! Then, my 30 minutes was over!

I left the machine to sit there glaring at me and came home. I turned on my trusty short-wave receiver — every station I tuned to (medium-wave, or short-wave) was carrying an item about 'the Internet'. I opened a hifi magazine to get some relief. You guessed it, computers, and the Internet, on virtually every page. Good Grief!

Come on folks! There's more to life than computers. In my opinion, computers are the greatest con ever to have been unleashed upon mankind. As far as I'm concerned, I will never touch a computer again as long as I live!!!

Terry Robinson, Woodend, Vic.

A fond farewell...

Sorry guys but if you're going to run Scott Adams' depressing drivel then I ain't buy your magazine anymore. So after about 25 years, byebye.

Jon Wells, (via email)

Circuit Safety

I refer to the Automatic Central Locking item in the Circuit and Design Ideas column, May 1999.

The circuit described only has the dashboard switch as an 'emergency' unlock. The problem is that it seems the circuit was designed for older persons. The safety problem is that, and I have seen it happen, older persons are more likely to have heart attacks and the like.

When in this case if person goes unconscious whilst driving the only way someone can help is by smashing the glass. This delay may cost the person their life.

The suggested modification is to have the doors lock while the vehicles brakes are applied. If the voltage at the lights is used as an indication of the brakes being applied then

Happy winner

What a pleasant surprise — an Australia Post delivery last Saturday morning with the splendid Tektronix TX3 Multimeter! I would like to thank both Tektronix and EA for the very useful prize. I have been an electronic engineer for over twenty years, with my professional activities now mostly confined to management. Consequently, my pursuits with a soldering iron are constrained to my home workshop.

The TX3 will be a most useful addition to my modest range of test instruments. I am planning some significant projects over the next few years dealing with self-sufficiency and solar power, so the TX3 will come in very handy.

I have been a reader and more recently subscriber to EA and its predecessor, R,TV&H for over forty years. In fact this publication to a large extent, set me on my chosen career of electronics. In my earlier days, I used to devour each issue from cover to cover and learned equally as much as I did later from formal study and engineering texts. I am sure I am not the only one. Much has changed over this time, with the field of electronics exploding into every facet of modern life.

There has been much pontification over the years on what should be covered in a publication such as EA. As you have now been in publication for nearly eighty years, you must be doing something right! It's a bit of a worry when one can remember many of the covers shown in the '25 years ago' history page; it will be a real concern when I can remember covers from 50 years ago!

Keep up the good work.

Peter N Churchill BE, CPEng, MIEAust., SMITEE
Kambah, ACT

the doors will also lock under hand brake conditions. As the circuit seems to be designed for when confronted by people when stopped at lights and in parking areas, this might be a practical modification.

Justin Mugford (via email)

Don't spoil EA!

QUICK, rush to the phone and ring the Newspaper Advertising Bureau of Australia (somewhere in North Sydney, I think). Urgently request their little publication by Colin Wheildon: "Communicating or just making pretty shapes".

When you get it, give it to your arty-farty layout designers and insist that they read it from cover to cover (it's not long). Hopefully then we'll get a magazine that sensible people can read fluently, without the comprehension of pages of text being destroyed by an extract that cuts right across the middle of the text (I've forgotten what it's called - is it a lift-out'?).

I'm deadly serious. This is a technical magazine aimed at technical people. You should be designing for comprehension, not eye-appeal. Based on some of the tests Wheildon reports, the readers' comprehension level of your articles has probably dropped from around 72% to about 37%. That's bad!

Don't let the layout 'artists' destroy a good technical magazine. I'd hate to see it disappear from the Australian scene.

Daniel F F Ford

Wot? No Vintage Radio?

While appreciating the need for any magazine to update its format from time to time, I was, as a long standing subscriber, disappointed to discover the omission of the Vintage Radio column in the April 2000 issue.

During a recent HRSA Membership Survey, it was established that some 14% of respondents first heard of the Society through the Vintage Radio pages of EA. This is of course good for the HRSA but also demonstrates that 140 of our nearly 1000 members are EA readers who enjoy reading the Vintage Radio column.

Hopefully the omission is only temporary and we will see the Vintage Radio column in future issues.

Warwick Woods, President, Historical Radio Society of Australia. (via Email) ■

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speakers around the walls of the auditorium, to involve the audience in crowd scenes and add realism to explosions, etc. This system evolved into the multi-track Dolby Surround system (later Dolby Stereo Surround, with two surround channels) which became standard in many of the world's cinemas.

In the early 1970s, record and tape player manufacturers tried to promote various four-channel systems for achieving surround sound in the home, but these 'quadraphonic sound' systems didn't really take off. There were compatibility problems, and in any case consumers at the time weren't too keen on the idea of having to have *four* power amplifiers and matching speaker boxes, instead of only two.

But although 'quad' wasn't popular with the majority of consumers, a few enthusiasts did find that using one of the simpler decoders, it was possible to achieve a modest but worthwhile 'surround' sound effect even from recordings and video movies that were nominally only two-channel stereo. That's because most stereo recordings *do* actually have some 'surround' information buried in them, more or less by default — and it can be enhanced by the recording engineers, using a system known as 'matrixing'.

So gradually, enthusiasts began using simple 'analog de-matrixing' decoders, of the type developed by an engineer named David Hafler, to produce a modest but acceptable surround sound effect from nominally 'stereo' recordings. This type of decoder works by adding the 'right' (R) and 'left' (L) stereo channel information together to produce a 'centre' (C) channel, and also subtracting them to get an 'ambience' or surround (S) channel. These two derived signals are then fed to additional amplifiers and speakers, to produce synthetic four-channel surround sound.

Before the end of the 70s, Dolby Laboratories came out with an enhanced version of this analog matrix decoding approach for cinemas, using a system of 'steering' circuits to give an improved surround effect. Called Dolby Stereo, it allowed even fairly small cinemas to provide four-channel surround sound from a two-channel optical sound track.

Dolby Pro-Logic

When laserdisc players began appearing in homes in the 1980s, the movies made available on the discs often had Dolby Stereo sound tracks, and the same applied when stereo VCRs became available. As a result home theatre enthusiasts found that these movies sounded better if they fed the stereo sound through a simple Hafler-type decoder, to 'resurrect' the hidden centre channel and surround channel information.

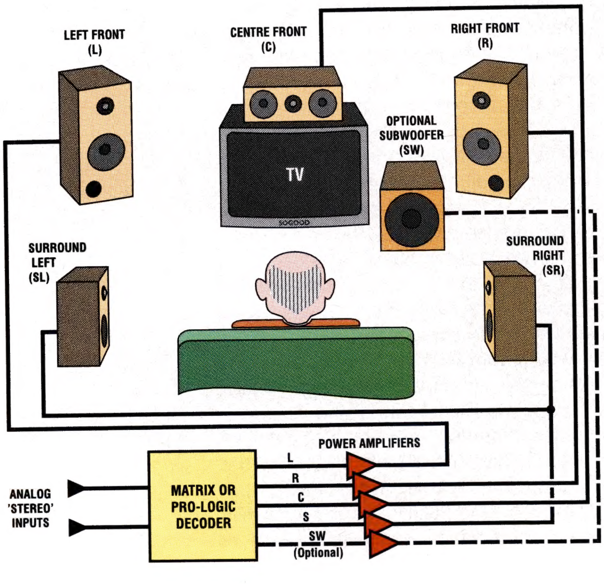
Noticing this trend, Dolby Labs came out with a domestic version of the enhanced decoders they'd produced for the cinemas. Known as Dolby Surround, it too was soon given improved steering logic and became the Dolby Pro-Logic system. Pro-Logic decoders were very soon produced as single IC chips, and began to be built into receivers and amplifiers for home theatre enthusiasts.

Since its introduction Dolby Pro-Logic decoding has gradually become more popular, especially for people watching movies at home, and is now available built into many small music systems.

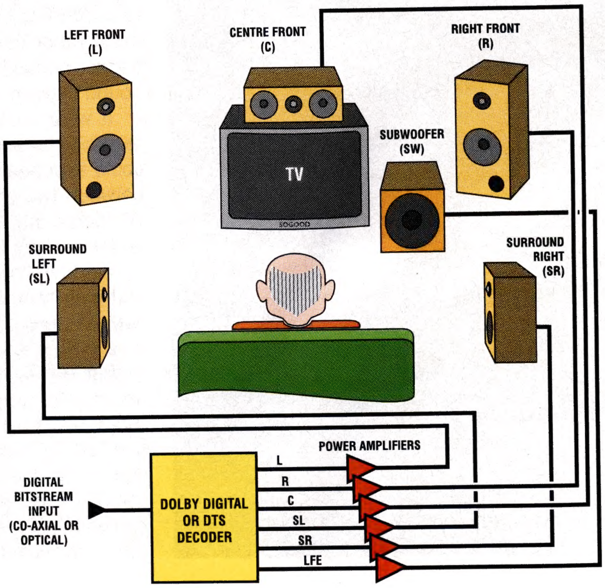
So probably the best way of visualising Dolby Pro-Logic is that it's the most developed form of the analog type of surround sound decoder. It can generally develop satisfying four-channel surround sound from nominally two-channel 'stereo' analog sound signals, using an enhanced form of matrix decoding.

As Pro-Logic decoding is now built into many small music systems, this generally makes it an attractive introductory way to provide yourself with surround sound. In any case it's the best way to get surround sound from software or players that produce only analog stereo sound, like CDs, stereo VCRs, older laserdisc players and low-end DVD players. The only cheaper way to achieve surround sound from these two-channel analog sources is by using a simple Hafler-type decoder.

__Analog__ surround sound (below left): just four channels, basically, although the two rear speakers are fed with the mono surround signal. The subwoofer uses the centre channel signal, via a LPF.



__Digital__ surround sound (below right): now there are 5.1 fully discrete channels, giving two separate surround signals to feed the rear speakers. There's also a separate LFE channel to drive the subwoofer.



Digital surround

So far, then, we've been talking about *analog* surround sound. Now let's look at the newer *digital* approach.

As you may recall, digital sound recordings first became available for home use in the 1980s — first on compact discs (1983) and then laserdiscs (1986). In both of these cases the discs allowed for two sound channels, producing high quality stereo sound. The recording system used is known as *linear pulse-code modulation* or 'LPCM', where the audio for each of the two channels is recorded as 16-bit samples, taken at the rate of 44,100 samples per second. The digital samples for the two channels are simply interleaved, to become a 'bitstream' of approximately 1.44Mb/s (megabits per second).

In the CD or laserdisc player, the samples are separated and passed through digital-to-analog conversion and filtering, to reproduce the original two channels of analog audio.

Now although this type of digital recording delivers excellent quality two-channel stereo, the only way to recreate a surround sound effect from it is to use a Dolby Pro-Logic or simpler Hafler-type decoder, as we've seen. But that's not what we mean by *digital* surround sound.

True digital surround sound dates from 1992, when Dolby Labs developed a system for recording up to six completely separate ('discrete') channels of digital audio on movie films — optically, and quite separately from the traditional stereo analog sound track. The new digital system was initially called Dolby AC-3, and then renamed Dolby Digital.

In 1995, Dolby Digital sound tracks also started to appear on home laserdiscs, in place of the original 'Right' channel analog sound track. Single-chip decoders for Dolby Digital surround also became available, making it possible to include Dolby Digital decoding in home AV amplifiers and receivers.

Because it offered up to six fully independent channels, instead of the four semi-independent channels of analog/Pro-Logic surround, Dolby Digital (DD) soon became popular as the medium for 'top quality' surround sound. Then when DVDs appeared in the later 1990s, DD quickly became established as the most popular type of sound track on these too.

There are other types of multi-channel digital sound recording besides Dolby Digital, as we'll see shortly. But DD is by far the most common, so I'll use it to explain a bit more about digital surround sound concepts.

Instead of the two discrete channels of digital audio you find on a CD, DD allows up to *six* discrete channels to be encoded. These consist of five full-bandwidth (i.e., 20Hz - 20kHz) main channels plus a 'low frequency effects' (LFE) channel with a bandwidth of 120Hz. It's for this reason that DD is often said to provide up to '5.1' channels — five full channels and the '0.1' LFE channel.

When DD is used to encode surround sound for a movie sound track, the five main channels are used for the front left (L), front centre (C), front right (R), surround left (SL) and surround right (SR) channels, while the 0.1 channel carries the deep bass information for the subwoofer (if used).

Now when these channels are recorded, the audio for each channel is generally turned into 16-bit digital samples and at much the same rate as for the two channels of a CD. Then the digital samples are again interleaved, to form the same kind of digital bitstream for recording on the DVD or laserdisc. But there's a crucial difference, because in this case the full 5.1 channels are squeezed into a bitstream of only 384kb/s — almost a quarter of the bit rate used for the two channels on a CD.

Clearly there's a trick to this, and the trick is known as *digital compression*. Without going into the details, this works by relying on a characteristic of human hearing known as 'auditory masking' — the way a loud sound at one frequency tends to 'hide' quieter sounds at nearby frequencies. And if these quieter sounds really aren't heard anyway, they won't be missed if they're not recorded. So by a complex process of analysing the digital samples for each of the incoming audio signals and stripping out the components that won't be heard ('perceptual coding'), along with digital 'packing' of what's left, the Dolby Digital encoder significantly reduces the amount of data that needs to be recorded.

The nett result is that up to 5.1 channels can be encoded into a bitstream of only 384kb/s, and then decoded at the playback end to recreate all 5.1 separate channels — with a sound quality that most people find just as good as the stereo from a CD.

As you might imagine, though, you do need a full Dolby Digital decoder to recreate and separate all of the sound channels encoded in a DD bitstream. That's why up-market DVD players and AV amplifiers which boast 'Dolby Digital 5.1 channel surround sound' tend to be more expensive; they have to include fairly complex DD decoding circuitry and multiple DACs (digital-to-analog converters), etc.

By the way, a DD bitstream doesn't *have* to carry the full 5.1 channels; it can contain anything from one channel (mono) up to 5.1 — including two-channel stereo (possibly with Pro-Logic analog surround encoding) or four-channel discrete surround sound. Exactly how many channels it does contain depends largely on the original sound recording for that movie or concert, etc. For example on DVDs or laserdiscs of old 'classic' movies you'll often find only DD mono, or stereo at best; discs of more recent movies may have say DD 4.0

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You can even base your home theatre setup on an integrated decoder, amplifier and speaker system like Sony's clever SA-VA100, shown here.

that there are two quite different basic types of surround sound technology: the older analog matrix/Dolby Pro-Logic type which can basically deliver only **four** surround channels, and the newer digital type — primarily Dolby Digital — which delivers a maximum of **5.1** channels and with much better separation.

Although a digital surround system has the *potential* to deliver a more impressive surround sound effect than an analog system, because of the larger number of possible channels and their better separation, in practice the difference may not be enormous. That's because it all depends very much on the original recording.

If the original recording was only mono, stereo or Dolby Stereo/Surround (as with most films made before 1991-2), there will probably be very little difference between the sound you'll get from a four-channel analog matrix/Pro Logic system and a 5.1-channel Dolby Digital or DTS system; the extra information just won't be there to decode.

In other words, you'll only tend to hear more convincing and impressive surround sound from a DD or DTS digital surround system when you're playing a DVD or laserdisc of a movie made since 1992, and where the movie itself was recorded in 5.1-channel DD or DTS. That's also assuming that the full original recording has been transferred to the disc, of course.

Also don't forget that the advantages of digital surround sound *do* come at a price — you need more expensive digital decoder(s), additional amplifier channels, more speakers and so on. Whether the ability to achieve greater sound impact from recent movies on DVD or laserdisc is *worth* this greater investment is a decision that only you can make for yourself.

THX certification

Before closing, you've probably heard terms like 'THX', 'Home THX' and 'THX Ultra' used, in conjunction with surround sound systems. What do they mean? Well, they're not really yet another kind of surround sound encoding, if that's what you were thinking.

Basically THX (which stands for Tomlinson Holman Experiment) is an initiative of Lucasfilm, which set out to establish the performance criteria needed for the various components in a surround sound system (decoders, equalising circuitry, amplifiers and speakers, etc) to ensure optimum sound impact — in both cinemas and home theatres. Home THX is the version of THX that applies to home theatre systems, and it's essentially a set of functional and performance specifications which equipment manufacturers have to meet, in order to be able to boast that their products are 'THX Certified'.

Home THX Ultra and THX Select are in effect two categories of Home THX certification, the first applying more to 'serious' home theatres and the second to less pretentious living rooms.

Surround EX

A little over a year ago, Dolby Laboratories and Lucasfilm jointly developed Surround EX, a system of effectively encoding — wait for it — 6.1 channels in a 5.1-channel digital bitstream. The additional channel is used for 'surround back' information, to allow the surround sound field to completely encircle the audience.

Surround EX seems to use a kind of enhanced matrix encoding to 'piggyback' the extra surround back channel information on the existing SR and SL surround channels of a 5.1-channel DD bitstream. However it also incorporates 'steering', retiming and extra equalisation, to improve the performance — a bit like Pro-Logic encoding.

George Lucas' own *Star Wars Episode 1: The Phantom Menace* was the first film released with Surround EX encoding, but quite a few of the very latest movies also use it as well

As it happens, though, the specification for Surround EX *decoders* also makes them 'backward compatible', or able to derive a synthetic surround back channel from the SR and SL channels of standard 5.1-channel DD recordings (again a bit like a Pro-Logic decoder). So if you buy an AV amplifier or receiver with Surround EX decoding capability, you won't have to wait until DVDs with 6.1-channel tracks are released — it will give you a similar result from existing discs with 5.1-channel tracks, in the meantime.

So perhaps it's easiest to visualise Surround EX as Dolby Digital further enhanced *with* Pro-Logic, rather than a totally new encoding system.

I hope this rundown on surround sound technology has clarified what it's all about, and given you the ability to pick the right kind of system for your particular needs. Happy surround sound listening! ■

***Below:** A guide to the surround sound coding used on DVD movie discs.*

1. Dolby Digital Mono This program features a mono soundtrack encoded to an AC-3 bitstream. When played through Dolby Digital equipment, sound will be heard from the center channel speaker only.

2. Dolby Digital Stereo This program features a stereo soundtrack encoded to an AC-3 bitstream. When played through Dolby Digital equipment, sound will be heard from the front left and front right speakers only.

3. Dolby Digital Surround This program features a matrixed surround soundtrack encoded to an AC-3 bitstream. When played through Dolby Digital equipment, sound will be heard from all five system speakers. The surround information will be monophonic.

4. Dolby Digital 4.0 This program features a discrete four channel soundtrack encoded to an AC-3 bitstream. When played through Dolby Digital equipment, sound will be heard from all five system speakers. The surround information will be discrete monophonic.

5. Dolby Digital 5.0 This program features a discrete five channel soundtrack encoded to an AC-3 bitstream. When played through Dolby Digital equipment, discrete sound will be heard from all five system speakers.

6. Dolby Digital 5.1 This program features a discrete 5.1 channel soundtrack encoded to an AC-3 bitstream. When played through Dolby Digital equipment, discrete sound will be heard from all five system speakers and a subwoofer.

7. PCM This program features an uncompressed digital stereo soundtrack for improved fidelity. When played, discrete stereo sound will be heard from the front right and front left speakers.

8. DTS This program features a discrete 5.1 channel soundtrack and must be played through DTS capable equipment. When played through DTS equipment, sound will be heard from all five system speakers and a subwoofer.

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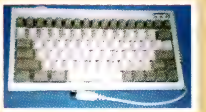

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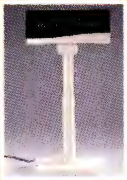
Cat. 8521	**Bar Code Laser Omni-Direct. KB Wedge**	$1999
Cat. 8573	**Bar Code Laser Omni-Direct. Serial**	$2119

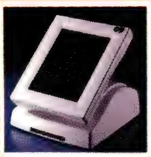
POS Customer Display



This POS customer display is driven from the serial port and has a vacuum fluorescent display with two lines of 20 characters. It is ergonomically designed with a 270 degree viewing angle .

Cat. 8728	**POS Customer Display**	$369

POS Touch Systems & Peripherals



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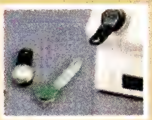
Cat. 8755	**POS Touch System with LCD & Swivel Base**	$4,490



Optional add-ons include a magnetic card reader, a magnetic I-Button reader with 5 operator keys for security access, an external FDD kit, Customer Display and cash drawers.

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Cat. 8757	**Magnetic I-Button Reader /5 keys**	$190
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Performance plus: Denon's AVC-A10SE

Denon's new AVC-A10SE five-channel AV surround sound amplifier boasts almost every feature and facility known to modern technology — including decoding for DTS as well as Dolby Digital, and even Lucasfilm's new 6.1-channel THX Surround EX. It also provides five conservatively rated 125W power amplifier channels, with well-nigh impeccable performance. **By Jim Rowe**

IN THE LAST YEAR or so, I've been able to evaluate a number of the latest generation of multi-channel digital surround sound AV amplifiers, and some of them have been very impressive. But one way or another they've all left something to be desired in terms of performance, features, facilities, operational flexibility, 'future proofing' or whatever. Until now, that is.

For the last few days I've been putting the new Denon AVC-A10SE through the wringer, and frankly this one is clearly in a class above the rest. In fact it's one of those products that are so good, writing a review becomes quite difficult because there's almost nothing to criticise!

In this case it also has so many features and facilities that I'm also having difficulty working out where to start. But I guess the best idea is to begin with the basics: the main power amp channels.

The AVC-A10SE has five power amp channels, all virtually identical and each rated at 125W continuous (RMS) into 8W for 0.05% THD, between 20Hz and 20kHz, and with two channels driven. The 125W rating also applies with all five channels driven, for 1kHz into 8W loads and 0.7% THD. The 'dynamic' power ratings for two channels driven are 170W x 2 into 8W, 270W x 2 into 4W and 350W x 2 into 2W, although the outputs seem to be designed to accept loads of 6 - 16W.

At this point I should perhaps note that unlike other digital AV amps I've evaluated, the AVC-A10SE power amp outputs are fitted with sturdy screw binding posts, with close-fitting 'skirts' to hold the wires underneath and removable nylon plugs at the top to allow the use of banana plug connections if you prefer. They're also spaced comfortably apart (30mm horizontally, 21mm vertically), so making the connections isn't a major hassle.

Rated frequency response of the main channels (in direct mode) is an impressive 10Hz - 100kHz (+0/-3dB), with a S/N ratio of 105dB and a THD of 0.005% at the 1W level.

So that's the basic platform we're looking at: five husky power amplifier channels, housed together with a matching power supply and thermostatically-controlled cooling fan in a very solid and nicely finished cabinet, measuring 494 x 434 x 181mm and weighing a hernia-tempting 21.5kg. Impressive enough already, you might think — but there's a lot more to come, especially in the AVC-A10SE's 'front end'...

Not surprisingly, there's a full decoder for 5.1-channel Dolby Digital (formerly AC-3) sound tracks. There's also a similar decoder for 5.1-channel Digital Theatre Systems (DTS) tracks. These decoders are based on a high-speed Analog Devices SHARC 32-bit floating point DSP processor, which also performs Dolby Pro-Logic matrix-type surround decoding for Pro-Logic and stereo tracks.

Quite apart from this processor there's a second identical 32-bit SHARC which performs Lucasfilm's THX post-processing, to give the AVC-A10SE a full 'THX Ultra' home theatre certification. Not only this but the same processor also performs decoding for the latest Lucasfilm/Dolby enhancement to the THX standard: Surround EX, which provides an additional 'surround back' channel to achieve a sound field which does completely surround the audience.

THX Surround EX

Surround EX is fairly new, and the first film actually provided with the extra channel information was George Lucas' own *Star Wars Episode 1: The Phantom Menace*, released only late last year. Obviously there are no movies as yet released on videotape, DVD or laserdisc with the extra channel, but that doesn't stop the AVC-A10SE: its inbuilt DSP processor can recognise an existing 5.1-channel surround track, and synthesise 'surround back channel' information of its own from the two existing surround left and surround right channels. So it can automatically generate a 6.1-channel presentation from existing 5.1-channel DD or DTS digital tracks.

By the way in case you're wondering how 6.1 channels of information can possibly be handled by only five power amp channels, they aren't. The AVC-A10SE doesn't attempt to handle the subwoofer (SFE) or surround back channel information from the decoders, in addition to the five main channels; it simply makes them available at line-level outputs, to drive external power amps. In fact it provides a total of 7.1 channels of 'front end' output at line level: front left-centre-right, surround left and right, the '0.1' SFE channel, and *two* surround back channel outputs. This is because the THX Surround EX specification apparently favours the back channel information being split between two amps and speakers ('surround back left' and 'surround back right') anyway, for smoother coverage.

Denon's designers have made the AVC-A10SE quite flexible in terms of which channels are fed through the internal power amps, too. You can set it up so the internal amps handle the three front channels and the two standard 'surround side' channels,

SUMMARY

- A digital AV surround sound amplifier with five 125W power amplifiers, Dolby Digital and DTS decoders and full THX Ultra/Surround EX certification.

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with an external stereo amp handling the new surround back channels, or alternatively you can use an existing stereo amp to handle the two main front left and right channels, and have the two freed-up internal amps handling the surround back channels. Switching between these two main amp configurations is performed (like just about all aspects of AVC-A10Se setup) using an on-screen menu system, and the settings are stored in flash memory.

Quite separately, you have a choice of two different configurations for the side surround channels, to suit whether you're using conventional or 'dipole' speakers for these channels, and exactly where they're placed. Labelled the 'A' and 'B' surround modes, these actually have two different sets of speaker terminals connected to the two side surround amps — so you can have both types of surround speakers connected if you wish, and use either or even *both* sets at will. How's that for flexibility!

Before moving on, I forgot to mention that as well as performing THX post processing and Surround EX decoding/synthesis, the AVC-A10SE's second 32-bit SHARC DSP chip also handles simulation of a range of synthetic-environment DSP surround modes for mono and stereo signal sources, THX bass management and so on — all in the digital domain, of course.

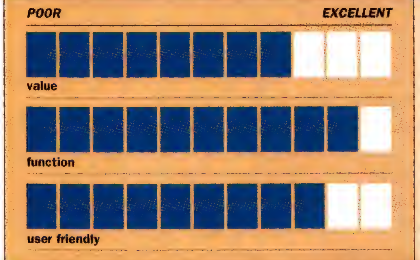
To allow all of this signal processing to be used with analog stereo inputs as well as digital, the AVC-A10SE has dual 20-bit analog to digital converters to convert analog signals into the digital domain. These apparently operate in all modes except 'Direct' stereo mode.

I might add here that the amp provides plenty of analog inputs. There's a total of 11 stereo pairs, including one (Phono) passing through traditional RIAA preamps and the rest at line level and marked Tuner, CD, DVD, VDP (i.e., Laserdisc), TV/DBS, Video Aux, VCR1, VCR2, MD/Tape-1 and Tape-2. And apart from these stereo inputs, there are not one but *two* sets of multi-channel analog inputs, to allow the use of external decoders for future digital encoding systems: one set of six-channel inputs, and another set of eight-channel inputs. Denon's designers are to be congratulated for their foresight!

You guessed it, there are plenty of digital inputs, too. In fact there's an almost mind-boggling array: five optical bitstream inputs, three coaxial bitstream inputs and even a Dolby Digital 'RF' input — to accept the bitstream modulated signals delivered by many of the last generation of laserdisc players, when they're playing discs with digital sound tracks. Whew!

The AVC-A10SE is also provided with other audio outputs as well, quite apart from the six sets of speaker terminals and the eight sets of line-level multichannel outputs. For example there are four sets of stereo pairs for feeding to external recorders, marked VCR1, VCR2, MD/Tape-1 and Tape-2. Then there's another stereo pair labelled 'Multi Source, which can be used to feed an amplifier in another room with a

PERFORMANCE: DENON AVC-A10SE



PROS

- Excellent power amps, conservatively rated
- Very flexible in terms of configuration
- Easy to set up
- Lots of inputs, provision for future enhancement.

CONS

- Weighs a tonne!

KEY FEATURES

- 7.1 channel playback
- THX Ultra certification
- On-screen display
- 24-bit, 96kHz D/A converters for all channels

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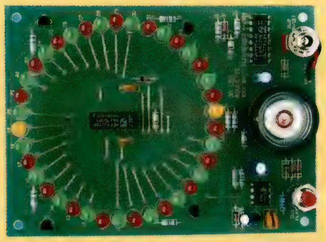
K 1430

NEW **$129**

KIT SPECIAL OF THE MONTH

Just like running your own casino! This fun kit simulates a roulette table. Simply press the button to set the ball rolling. Makes a clicking sound as each number is passed, imitating a ball rolling over pockets. Operates from a single 9 volt battery (not included) and is supplied with PCB, mini speaker, switches, and all necessary components.

K 2804



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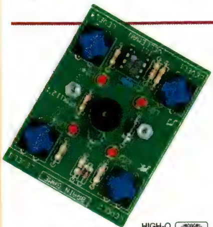


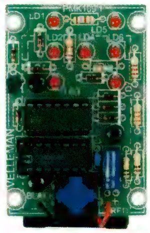
velleman-kit HIGH-Q

Brain Game Minikit

The aim of the game is to repeat a pattern which is generated at random. The pattern is played both visually and audible or visually only (selectable). Features 4 difficulty levels which can be selected at start-up. The replay speed gradually increases during the game to make it even more challanging. This kit is microprocessor controlled.
Kit supplied with PCB and all necessary components.
Power source: 3 x AA batteries (not included)

K 1337

$29.80 NEW



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K 1330

velleman-kit HIGH-Q

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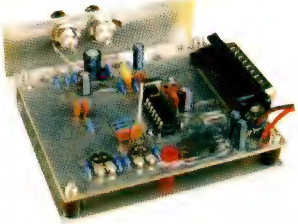
K 5417

$32.80



EA Aug '99

Car LED Voltmeter Kit

SAVE $3

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K 4205

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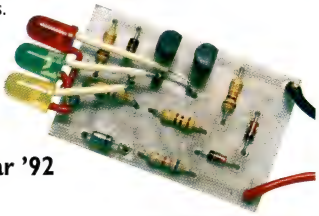

EA Mar '92

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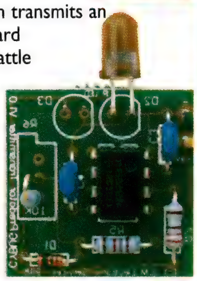
SAVE $5

Add-on boards for the Cybug Robot Bug Kit (K 3560) to give your robot extra characteristics. Includes two modules: the Prey board which transmits an IR signal, and the Predator board which seeks and hunts prey. Battle your Cybug against your friend's or watch two Cybugs interact as one chases the other around the room.

K 3561

$34.80



EA Apr '99

Car Digital Tacho Kit

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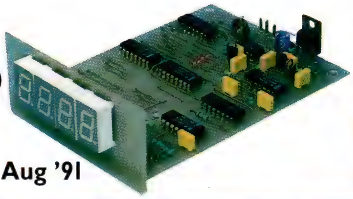
4-6 digit display works with ignition systems on 4, 6 and 8 cylinder motors. Supplied with components, PCBs and LED display.
Power source required: 12V DC.

K 3241



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K 4208

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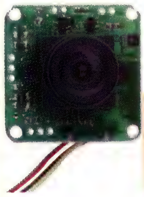

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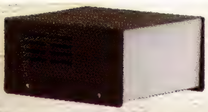
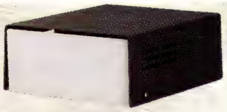


Metal Cabinet

150 x 76 x 134mm.

H 2743 LIMITED STOCK HALF PRICE **$7.45**



Metal Cabinet

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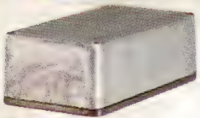
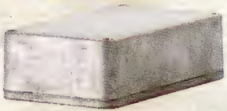


Diecast Aluminium Box

122 x 41 x 66mm.

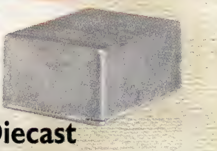
H 2211 HALF PRICE **$7.45**



Diecast Aluminium Box

110 x 31 x 62mm.

H 2202 LIMITED STOCK HALF PRICE **$8.25**



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D 1746

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D 1747

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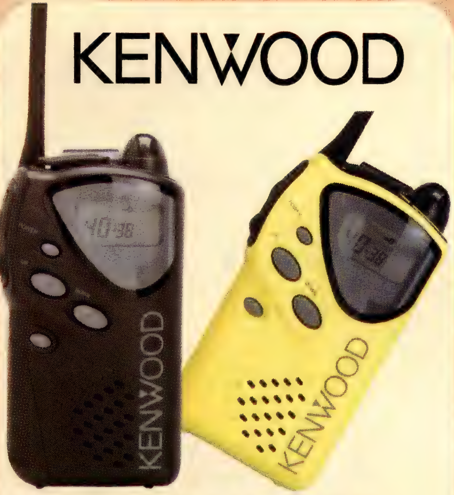
KENWOOD



Kenwood UHF CB

The Kenwood UBZ-LF48 is a compact, handheld UHF CB transceiver that provides coverage of the 40 channel UHF CB band with 300mW RF output, repeater access facility, Selective calling, and a flip-down flexible antenna.

D 1744 **Yellow**
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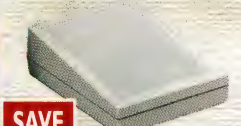

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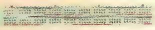

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H 4033
$1
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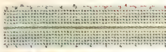
BELOW COST!



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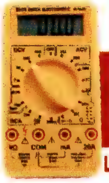

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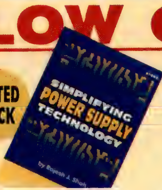

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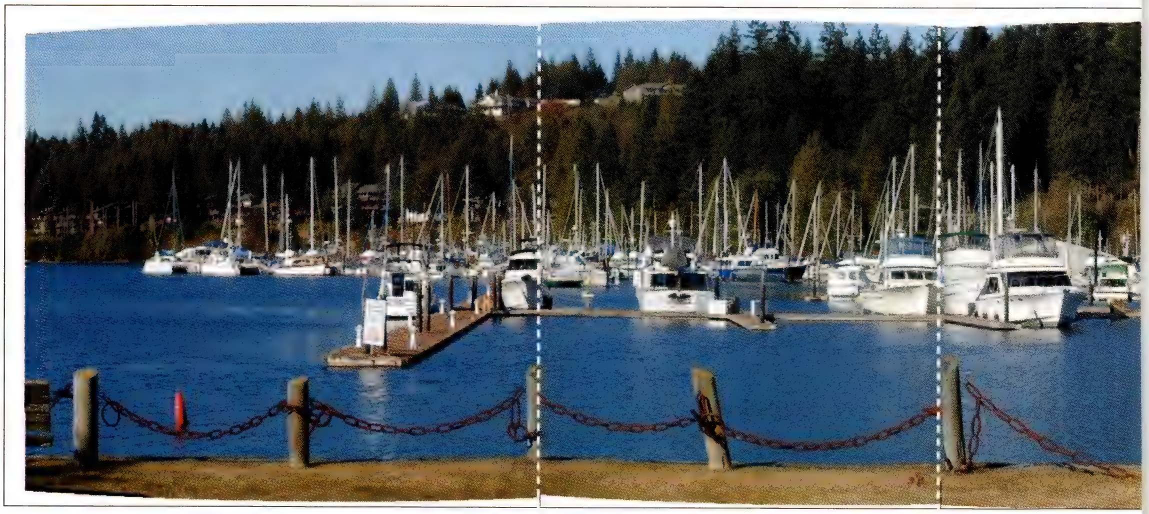
Olympus C-2000Z

Following on from last month's article, **Tom Moffat** continues his report on the Olympus C-2000, and covers a few of the features available on this professional digital camera, along with a look at the need for megapixel resolution, even in low resolution images.

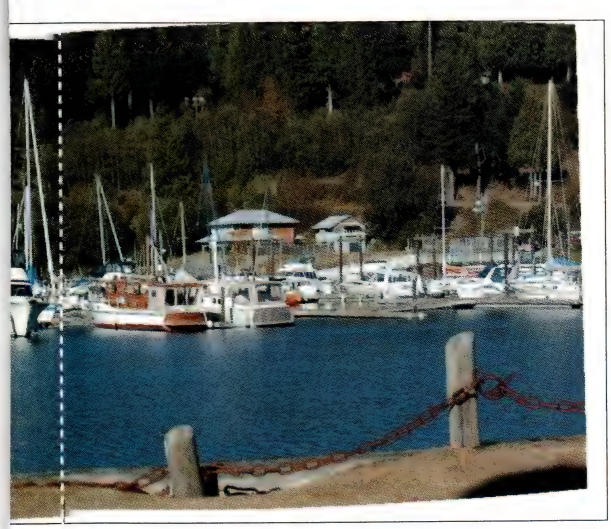


***Right:** The marina panorama from last month, with the stitch marks shown. Some fancy image analysis is done by the QuickStitch software as the four separate shots are glued together.*

Above: *Tom's stylish cafe scene shows the C-2000's capabilities to good effect.*

LAST MONTH I covered the question of digital *vs* film cameras, and started covering some of the features available with my Oly — the Olympus C-2000 I acquired a while ago. With a lot of modern digital cameras, they seem to try and pack in as many gimmicks, bells and whistles as they can, but the Olympus C-2000 has a number of features which on the surface look like gimmicks, but on the whole are pretty useful.

For instance, there is a shooting mode where you hold down the shutter release and the camera blasts off a series of shots, just like a motorized Nikon. I've never found need for this, but if you are working for a newspaper as a sports photographer, or fending off the cops at Seattle's World Trade Conference demo, burst mode is a must.

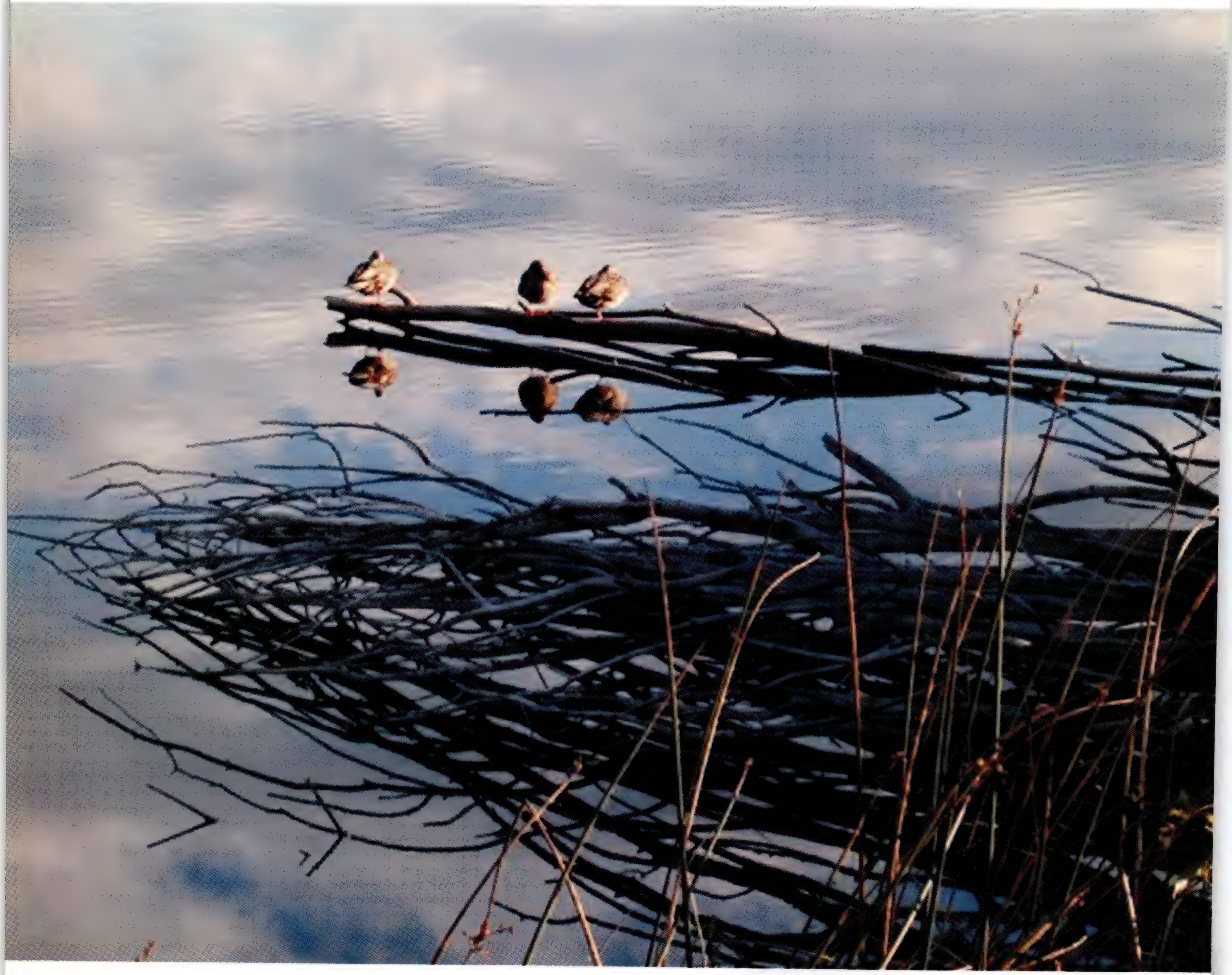


The camera also comes with a tiny IR remote control which lets you control the zoom lens, the exposure compensation, and then fire off a shot. This means you can get into the picture too. But you could also do some sneaky stuff — say park the camera on a shelf during a party, with the flash turned off so it won't attract attention. Then you can stand with the other guests, collecting lots of incriminating information as they make fools of themselves. The IR remote works reliably across a very large room.

Speaking of flash, the Oly seems to work very well with its automatic exposure control. The kitchen scene is a large open area with some lighting of its own, but the flash photo, with all the wood and pots and pans, came out warm and beautifully balanced. This is typical flash performance.

Digital sticky tape

A throwback to the good old days of photography is the panorama. You've probably seen hundred-year old shots of a whole city, and its waterfront, and its mountains - a series of individual negatives all strung together. I have seen some wonderful panoramas of Hobart, and once got inspired to make my own by shooting a series of adjoining images, printing them



Right: *A kitchen scene showing how well the C-2000's automatic exposure control works with its built-in flash.*

on 10 x 8 paper, and then joining them together with stick-tape. This works, but the joins are very obvious.

Now Olympus has come up with a seamless panorama mode. You take the pictures in the traditional way: shoot, turn a little, shoot again, turn a little, and so on. But now the sticky-tape has been replaced by computer software that 'stitches' the individual photos together, seamlessly. Most of the hard work is done by some software called QuickStitch, that comes bundled with the C-2000 camera. But, interestingly, part of the panorama functionality is hard-coded into the Olympus-brand memory cards.

Cynics would say this was done to lock you into buying only Olympus memory cards, but I suspect the motive is somewhat more honest. The camera's firmware is there forever, unchangeable, but if Oly decided to come up with some new you-beaut feature or function, they could encode in on future memory cards, perhaps in conjunction with the existing panorama feature.

My first attempt at a panorama was meant to be a stunning mountain vista, shot from the top of a 6200-foot peak. Trouble is, somebody had failed to read the instructions, which said the camera had to be programmed in advance to pan left, or pan right, between shots. So the camera thought I was going to pan left, and I instead panned right, and there was no way the resulting pictures would stitch together within the computer. Oh well, it was good exercise anyhow, slogging up that mountain.

After some indoor practice making panoramas of my living room, I took the camera to a sea-level marina (less climbing!) where I produced the panorama shown here. That was four or five photos, all electronically strung together. There's some fancy image analysis going on in this process, resulting in certain features being slightly twisted or bent to fit. You're supposed to crop the rough edges off your panorama but I've left them intact so you can see how the stitching procedure works. When I get the time I'm going to play around with panoramas some more. Good fun!

Memory cards

Almost every current digicam uses come kind of removable memory device to store the pictures. The traditional way to get them into the computer is to download through the serial port. Even at 110k baud, this is a slow process, especially with the whopper file sizes of the latest megapixel cameras. So the latest thing is to pull the picture-laden memory card from the camera connect it directly to the computer.

Since I use a laptop, I bought a SmartMedia-to-PCMCIA adapter which plugs into the side of the computer. The memory card then slides into the adapter. The memory card then looks like another disk drive, filled with JPG files. I use a picture viewer to pick through them, saving the good ones to the hard disk and deleting the others. Then the card is returned to the camera, empty and ready for more action.

There are several competing memory card standards right now — Compact Flash, SmartMedia, and Memory Stick among them. I have found a gadget called 'Connect Pro 3 Slot' which has just that — slots of three different standards. It plugs into the printer port of any computer and then appears as another disk drive, just like my PCMCIA adapter. I haven't tried one of these but it does seem a good alternative to the slow serial cable.

Making more of Megapixel

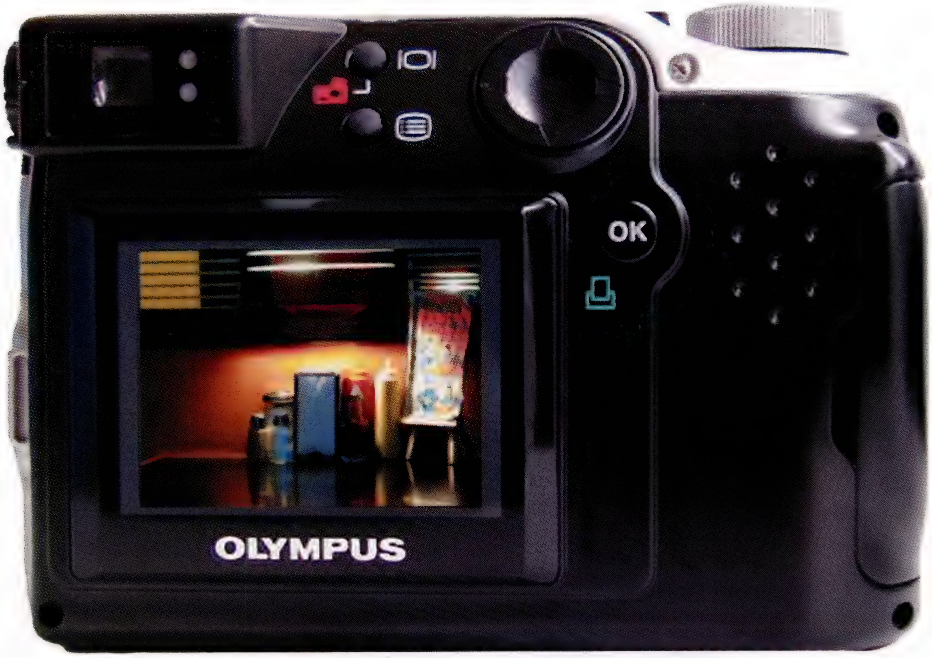
Here's where conventional wisdom is blown apart by experimental evidence. For the moment, let's ignore the fact that many digital pictures will end up getting printed onto paper. Let's stick to viewing them on the computer screen, and on web sites, or e-mailing them to friends.

Megapixel digital cameras like the Oly can produce images as large as 1600 x 1200 pixels, with 24 bits per pixel. That works out at 1.92 megapixels, somewhat less than the 2.1 megapixel CCD specified for the Oly. One suspects that the CCD is round, and the image is rectangular, so some of the CCD pixels are wasted.

Anyhow, with 1.92 megapixels and three bytes per pixel, we have an uncompressed file size of 5.76MB. The Oly is able to produce TIF files of this resolution to make the very best use of the camera's CCD, but the memory card does tend to fill up pretty fast. A 16MB card like the ones I use will hold only two of these images.

Here's where JPEG compression comes into the picture, of two 'strengths' in the Oly camera. The weakest compression produces files of about 900K, which is a big improvement on the original 5.7MB. The stronger compression scrunches them down to around

Above: *Tom's been having great fun popping off shots around his local area.*



Above: *Framed and ready to go, here the LCD shows the cafe scene shot from p41.*

Below: *Tom's complexion has clearly gone to pack, but thankfully, he seems to have very understanding friends.*

450K. What's being compressed here is the **detail**; the image size remains at 1600 x 1200 pixels. The compressed file sizes vary somewhat depending on picture content.

I've done some very revealing tests, shooting one highly detailed scene in all three file sizes — 5.7MB, 900K, and 450K. Then I've cropped the same small section from each of the three images and lined them up with a photo editor so they can be viewed side by side. I have found, in the real world, at least on a computer screen, the difference is almost undetectable. So now I shoot almost everything in the 'HQ' JPEG mode, the 450K file size. Storing them is no problem since I have a CD-ROM burner.

But this still seems wasteful. My computer screen can only display 800x600 pixels, and the HQ JPEG pictures are four times that size. I could use the 1024x768 mode, or even the 640x480 mode, and save heaps of file storage space. In fact, when I first got the camera, I used the 1024x768 mode because it was the next size larger than the computer. The display software reduced them to the correct size.

But I soon learned that, all other things being equal, the 1600 x 1200 images *looked* much better than the 1024 x 768 images, when both were electronically reduced to 800 x 600 for display on the screen. I have a theory why that is so, which is related to the facts of life in film photography: the bigger the negative, the more raw data it collects, and the better the picture for any given display size.

In electronic imaging, the bigger 'negative' size somehow seems to improve the sharpness of the display. And there's also an improvement in colour reproduction; that almost undefinable 'look' of the picture. The moral of the story is, for me at least, SHOOT BIG if you have somewhere to store the images. If you don't, buy a CD burner.

Half-megabyte attached files tend to constipate e-mail programs. Smaller files are much easier and quicker to handle. So for maximum scrunching you can use a picture editor such as Paint Shop Pro to resize a 1600 x 1200 image down to something more manageable like 640 x 480. The file size should then be less than 100K. An alternative would be to shoot the pictures as 640 x 480 in the first place, in which case a 16MB memory card would hold 244 images. But the resulting quality is far inferior to pictures electronically reduced from a larger size. Again, the 'big negative' theory holds.

In the case of printing, a decent printer might offer 600 dots per inch image resolution on the paper. If printed pixel for pixel, the printer image wouldn't be much larger than a postage stamp. So the printer has to somehow manufacture several pixels from one incoming pixel. The more pixels it has to work with, the better the result will be.

The update that wasn't

You know the drill. You buy some new gadget, and before long it's superseded by an even better gadget. This happened to me. About three weeks after I coughed up nearly $800 (US) for my Olympus C-2000, another model came along called the C-2020. It looked identical to the C-2000, but it had some changes that addressed some problems in the C-2000. For instance — that lack of full exposure and

focus control that only revealed itself after purchase of the camera. There was also a problem in the C-2000 where you couldn't turn off the camera's built-in flash when you wanted to use an external flash. The officially recommended solution was to put a handkerchief over the camera's built-in flash. The C-2020 apparently corrects this.

Users understandably saw the C-2020 as a bug fix for the C-2000 and were wondering when Olympus would be calling in the C-2000 models for upgrade. As it turned out, there was no upgrade path, and those of us who bought the buggy model were stuck with them. Olympus eventually released a statement saying *"We have listened to the customers who have asked for changes. Olympus reviewed these and implemented some of them in the C-2020 Zoom, their new camera. Like a new computer i.e. Pentium III or G-4, many of these changes are hardware not firmware and required a new product. There is no way to upgrade..."*

However there is feeling in the internet newsgroups that the C-2000's picture quality might have been slightly compromised when the design was changed to the C-2020. For instance, one very detailed test showed background noise on a dark image to be considerably higher on the new C-2020 than on the older model. A published comparison of C-2000 *vs* C-2020 pictures of the same scene shows an obviously different colour balance in the 2020 — more yellow, less blue.

Anyhow, that's nit-picking. I think we're pretty fortunate to have any cameras of this quality available to amateur photographers. In a couple of years both Olympus models will be old hat — that's what we've learned to expect. Maybe by then I'll be able to afford that Nikon digicam I've always been lusting for — one that uses my existing Nikkor lenses...■

Below: *A 64MB flash card for the C-2000. That's the camera's IR remote lurking in the background.*

> *clarity of purpose. Of course, whenever HE was used it always meant HE and SHE except when it was clear from the context that only a male subject was referred to. My feminist daughter showed me the planned progression as follows (obvious in university lecture notes and textbooks):*
>
> *HE - HE/SHE - SHE/HE - SH/HE - SHE.*
>
> *You might laugh, but one day you will understand and speak like that!!*

That was the end of this part of Mr de Pree's letter, and I think he's made his point — or should that be he/she has/have made *their* point? Frankly although I don't doubt that he's right, I can't get too worked up about it. Grammatical and/or political correctness in written expression is such a dynamic entity that I've long since given up trying to follow it too closely. Nowadays I just try to write as clearly as I can, and in a fairly friendly style. Beyond that, I've learned to stop worrying and simply dodge the brickbats when they come whizzing past occasionally, from people like Mr de Pree!

Bearing that in mind you might like to read the last part of Mr de Pree's letter, on a topic of somewhat more technical interest:

> *On a totally different subject (I only write every few years), when reading through articles discussing the testing of loudspeakers I am reminded of one of the ways Philips did it in Holland. I worked at their research institute for some years. It is a massive setup, where research is conducted on a pure scientific basis, i.e. without always having a commercial purpose.*
>
> *I worked in the ultrasonics section and during the lunchbreak often visited other areas to see what was being done there. Also being very interested in hifi, I spent quite some time in the acoustics section. After loudspeakers were thoroughly tested in the anechoic chamber, there was a most interesting test. A room would be divided in two by a curtain that blocked the view into the other part. On one side a member of a symphony orchestra would be playing an instrument, while on the other side of the curtain would be another member of the orchestra. Also there were engineers and instrumentation all over the place.*
>
> *The non-playing musician had the task of deciding whether his colleague was playing, or whether it was a playback through a loudspeaker. Philips employed the most sophisticated instrument ever designed for acoustic tests: the human ear. It was interesting to see that quite often the musician was unsure what he was listening too. It depended on the instrument(s) being played; some reproduce better than others.*
>
> *I still use a set of gigantic loudspeaker enclosures I built in those days (35 years back) — double cone, 10W speakers in an organ pipe setup. Low power, yes, but ear deafening if it has to. Also a valve amplifier which is straight within 3dB to 200kHz. It puzzles me why 20kHz is the cutoff nowadays; if you listen to classical music then the 200kHz gives very obviously better reproduction on the violins and other stringed instruments where the 'attack' is concerned.*
>
> *Well, this is enough for now. I haven't written this letter for publication, but if you want to reproduce some of it, then by all means go ahead.*
>
> *I wished I could end with some constructive comments about the magazine, but I can't, it is just right the way it is. I appreciate the mammoth task you all have there in putting it together every month, on time.*

Thanks for those comments too, Mr de Pree, and for the compliments. To be honest I found this part of your letter more interesting, especially the bit about Philips using a set of musically trained human ears as an acoustic test instrument. I doubt if we can *all* claim to have the same capabilities, though. In my own case the acoustic sensors are starting to show the effects of nearly 61 years of use...

By the way I am a bit surprised at your own puzzlement about the focus on a 20kHz cutoff. It's essentially just the result of swinging over to digital recording and choosing a sampling rate of 44.1kS/s for CDs, and not much higher (48kS/s) for DVDs and other media. And these rates were chosen largely on the basis of balancing technical performance with economics, I believe.

Presumably it's partly pressure from people like yourself, with good treble response, that is encouraging the recording industry to move towards releasing CDs and DVD-Audio discs with 96kS/s and higher sampling rates, and 24-bit sampling to boot.

Hearing risk

That said, let's move on again — but to a topic that's still concerned with sound reproduction and human hearing. Our next letter comes from reader Clive Singleton, who hails from a place called Wainuiomata in Lower Hutt, New Zealand.

As you'll see Mr Singleton is responding both to EA editor Graham Cattley's leader in the October issue last year (about modern technology and its potential for misuse) and a story he saw in a NZ newspaper. I'll present his letter first, then summarise what the newspaper story was about:

> *The very last words of the October editorial about whether modern technology is always a good thing were '...but the potential for misuse is ever growing as those toys become more and more powerful'.*
>
> *Well not long after reading that, there was a piece in our Wellington newspaper, of which I have attached a copy. With a hearing loss myself, I felt strongly enough to write a letter to the Editor, who saw fit to publish it with picture in a special box. A copy of that letter is also attached.*
>
> *Being a believer in one letter one subject, I said nothing about the accident potential. But how anyone can drive properly with their brains being pummelled by that mindless noise is quite beyond me.*
>
> *As Electronics Australia has been known to publish things about powerful car sound systems, I thought you may like to use this material in Forum and maybe make people think about the dangers involved. Who knows? It may stir up a bit of discussion.*

Thanks for that letter, Mr Singleton, and after that introduction I'll now give other readers a brief precis of the newspaper items you sent.

The original story appeared in the issue of *The Evening Post* for October 21, 1999 under the by-line of Kate Perry. It concerned Steve Myers, 23, a retail manager who is said to have paid about NZ$35,000 getting a high-powered sound system installed in his 1992 Maxima car, which before that was worth NZ$8000. The system apparently includes two amplifiers rated at 5kW output, 300m of extra cables, two extra batteries and an array of 10 speakers, including four big woofers in the vehicle's boot — visible in the photo along with a somewhat bemused Mr Myers.

The story relates that Mr Myers wanted 'fat-cat sounds', and had the system installed by a firm called Street Soundz. Apparently he's quite happy with the result, too, although he describes the system as making him 'feel ill after sitting in the car for about five minutes', and 'making Street Soundz manager Arjay Magan's nose bleed when he was sitting in the car listening to it'. It has apparently also prompted neighbours living on a hill 500m away to complain to the police about the noise...

Hmmm — it sounds a bit like some of the vehicles that rumble and roar their way along the road we live on from time to time, with their approach and departure accompanied by a long buildup and equally long decay of an endlessly repeating bass rhythm. I have a few politically incorrect terms of my own to describe *their* owner/drivers too, especially when they wake me up in the wee small hours!

Seriously, though, there's no doubt that while installing and using this type of overblown mobile sound system may be great for the egos of young blokes with a surplus of money and testosterone, the fact remains that they can easily produce sound pressure levels sufficient to cause permanent hearing loss. So the young blokes concerned, and their passengers, are very likely indeed to end up paying a much higher price for their 'fun' than they expect.

It's an aspect of these systems that isn't mentioned nearly enough, and that's why Mr Singleton wrote his letter to the paper concerned. In it he tried to describe what may well befall Mr Myers and other owners of such systems in later life, as a result of their loss in hearing — and also pointed out that to a large extent hearing loss is itself not treatable or reversible, even for $35,000.

Good on you, Mr Singleton. You were right on the button, and it was very altruistic of you to try warning 'fat-cat sound' enthusiasts like Mr Myers of the dangers of these systems to their own hearing.

Mind you, I doubt whether they'll take much notice. At that age, most young males are mainly interested in impressing young females and their mates, with the brightness of their plumage and the way *their* sound system can produce bleeding in the noses and ears of lesser mortals. As for their own capability to withstand such rigours, that's really not in question. After all, they're young and bulletproof — and besides, by the time *they* might get deaf there'll probably be a simple operation to restore their hearing, won't there?

Perhaps they're right, too, although I doubt it. ■

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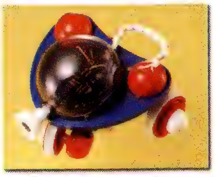

This little guy will try to find his way around and will back-up and change direction when he (or is it she?) hits an obstacle. This cute little self-contained robot is fun to build & amusing to watch.

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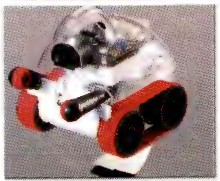

He might look small, but he is one of the toughest little robots around. Sumo man can be set for "attack" mode or "avoidance" mode. Sensitivity and reversing time can both be adjusted as you "train" your robot for peak performance.

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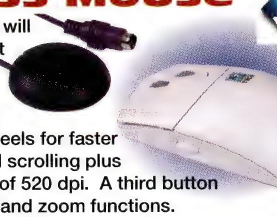

A cable free mouse will enable you to forget short & tangled mouse cables forever. The mouse features 2 scroll wheels for faster horizontal & vertical scrolling plus superior resolution of 520 dpi. A third button enables auto scroll and zoom functions. Compatible with Windows 3.1/95/98 & NT, the mouse comes with an operators manual, driver software and remote receiver.

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This sophisticated transceiver operates in the 433Mhz band & uses the full legal power to provide up to 1km line of site range. The transceiver has CTCSS selective calling, a clock with alarm and stopwatch capabilities, low battery indicator, 10 different paging tones, LCD display, plus 10. Best of all, you don't need a license to use it and could save a fortune on expensive mobile phone calls. Comes with belt clip and instructions. Requires 4 x AAA batteries (not supplied). Units measure 65(W)x 105(H) x 30(Dmm.

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Cat DC-1002 Purple
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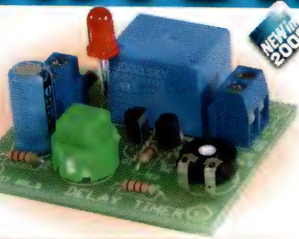
Simple Timer Kit

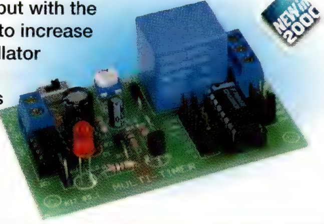


This timer kit uses the discharge rate of a variable resistor/capacitor circuit to act the basic timing circuit. Timing range is from 2 seconds to about 6 minutes.

Cat KD-6016 KwiK Kit

$16.95

555 Timer with Ripple Counter



This kit is similar to our KD6014, but with the addition of a 4020 ripple counter to increase timer duration. By adjusting oscillator frequency and selecting counter outputs, time periods from 100ms to approximately110 days can be achieved.

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555 Timer Kit

This kit can be set to trigger from anywhere between 100ms to approximately 20 minutes. The timer controls a relay and can be used to switch a device on or off for the timed period. Features reverse polarity power protection, start & reset switches and variable time control. •Kit includes silk-screened solder-masked PCB (60 x 42mm), relay and all electronic components. **Cat KD-6014**

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44mm	43.6	37	23	250	260

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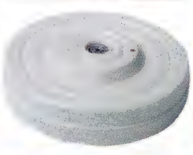

*Spend $50 during 1 visit to a Jaycar Store in January and ask for your free pest repeller at that time. It will keep moths out of your wardrobe, or pantry etc. *Not available at trade.

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•Triple display •2 x 3.75 digit •1 x bargraph •Can measure two factors of one electrical quantity •Auto ranging •Manual ranging overide •Recording (min, max, avg) •Secondary digital display shows recording time •Relative mode (real time value less reference value in units or %) •Auto/manual data hold •Frequency •Transistor /diode test •10A •Capacitance test •40 meg •Holster included •Percentage tolerance •auto power off •stop watch •41 dot bargraph •rugged construction •safety test leads •dual slope integration etc.

Cat. QM-1270 **Was $139.86 Save $10.86** **$129.00**

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Ideal for small surveillance installations, this purpose built B&W security monitor has an built in switcher. The switching time can be adjusted with the front panel control and is variable anywhere between 2 to 20 seconds. Audio input is automatically synchronised to the video channel displayed. Video and audio output signals allow the monitored input to be relayed to another monitor or video recorder. Monitor measures 170(W) x 140(H) x 190(D)mm. •6" diagonal CRT •2 to 20 second timer delay •2 video inputs •2 audio inputs •1 video output •1 audio output •15W power consumption •Weight 2 kg.

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Indoor / Outdoor Mini Speakers

If you heard these speakers without seeing them, you would think they were much bigger. The speakers have a special weather resistant coating. Brackets are supplied for mounting, and there is a metal grill over the front. These speakers are ideal for surround sound, or outdoors on the patio or around the pool.

- Cabinet size: 195(H) x 140(W) x 130(D)mm.

•Power handling: 30 Watts RMS •Speakers: 4" Woofer and 2" Tweeter, both high compliant •Impedance: 8Ω •Frequency: 20-20Khz •Colour: Black

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The easy way to extend the length of CCD camera cables. The leads have 3 joined cables, BNC plug to plug, RCA plug to plug, and DC power male to female. The video cable used is quality RG59U, and the power cable for the shorter lengths is 24 gauge, and the 2 longer lengths is 18 gauge.

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An affordable way to work / type / solder....etc while you are talking on the phone.This is NOT a handsfree adaptor, it is a stand alone unit, and as such connects to your normal modular telephone outlet, not to a telephone system (eg. Commander). NOTE: This unit does not require batteries or external power - it is powered from the telephone line.

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We are always on the lookout for good ideas, and this is one of them. This tip cleaner eliminates the temperature variation associated with the wet sponge approach and does a better job to boot! The special "Curly Brass" insert does not need to be kept wet and cleans without damaging the tip. •Measures 90 mm dia. x 40 mm high.

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- Large 3.5 Digit Display
- Holster Included

A quality, 2 input industrial thermometer with a large, easy to read LCD display. Functions include "HOLD" which keeps the current temperature and stops further measurement and "MAX", which will display & hold the maximum temperature recorded. Temperature can be displayed in either Celsius or Fahrenheit. Resolution is switchable between 1° and 0.1°. Two detachable K-type thermocouples supplied with the unit. •Measurement range: -50°C to +1300°C, •Operating temperature: 0°C to 50°C •Dimensions: 78 (W) x 170 (L) x 50 (H).

Cat. QM-1600

$99.00

Remote Control For Central Door Locking

Cat. LR-8831

Never fumble with keys in the rain again. If you already have central locking on your car, you can now upgrade it to a remote keyless entry system with this terrific device. Unlock your car on those wet and windy days with a press of a button as you approach. Spare remote available Cat. LR-8836 $29.95

MAY $69.95

4 Door Car Central Locking Kit

Cat. LR-8830

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RESPONSE DOUBLE MAGNET CAR SUBWOOFERS

Two subwoofers 10" & 12" with huge 250W RMS power handling, cast aluminium, double magnets, huge frame & dual voice coils, small box size, 10" 35L, 12" 45L

Car Stereo Aust. Magazine #10

"After testing our CS-2228 12" Subwoofer"

"The Jaycar speaker surprised me a lot. Looking at its beefy business like construction, I expected it to sound big, brash & brassy. Instead it offered the smoothest most linear sound of the group. Even at low volume this sub still exhibited excellent warmth, weight and authority (exceeding many of the 15"s I've reviewed) but when fed lots of power the Jaycar speaker didn't lose any of its tonal accuracy or control, sounding just as balanced with the rest of the system as it did at low volume". **These drivers are awesome!**

10" SUBWOOFER

Cat. CS-2226

Was $249

Now $229 **Save $20**

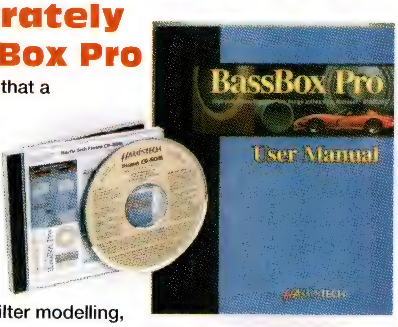
12" SUBWOOFER

Cat. CS-2228

Was $269

Now $249 **Save $20**

Design Speaker Boxes Fast and Accurately with BassBox Pro



Bass Box Pro proves that a professional-strength box design program can be both easy to use and affordable. With powerful features like a "Design Wizard", interactive driver parameter verification, external filter modelling, an advanced database with the specs for thousands of drivers, nine performance graphs and custom printouts. BaseBox Pro excels at box design.

Cat. XC-5020

$229.00

CCD Video Intercom System

Can you see who’’s at the door or gate before you open it? This modern style system with a 4" B & W flat monitor. should help to reduce the risk of an unpleasant surprise day or night. For full specs see page 132 of our 2K catalogue.

Cat QC3410

Was $439

Save $51

NOW ONLY $388

External HHD CD-ROM IDE Case

NEW in 2000

This versatile case is designed to interface standard 1/2 height IDE/ATAPI drives via your PC's printer port and features a 'pass through' printer connector. The case includes its own power supply and a selection of faceplates to accommodate a hard disk, CD-ROM or removeable disk drive. •Software drivers are supplied for DOS and Windows 3.1/95/98 & NT. •Includes connection cable to the PC's printer port and a mains power supply. •Case measures 210(W) x 60(H) x 275(L)mm.

Cat. XC-4672

$179.95

30 Piece Full House Security Bit Set Tool Kit

A totally comprehensive driver bit set for servicing almost any appliance! This set consists of: Torque - set bits 6, 8, 10; Tri - wing bits 1, 2, 3 and 4; Spanner (snake-eye) bits 4, 6, 8 and 10; Tamper proof hex bits 5/64", 3/32", 7/64", 1/8", 9/64" and 5/32"; Torx tamperproof bits T8H, T10H, T15H, T20H, T25H, T27H, T30H, T35H and T40H. All bits are in chrome vanadium so they will last.

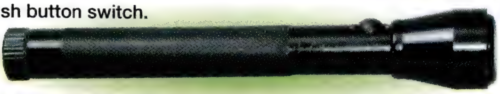
Cat. TD-2001

Was $24.95

May $13.95 **Save $11**

Machined Aircraft Grade 2 x AA Cell Aluminium Torch

A quality waterproof metal torch that won't cost you a fortune. It is longer than our standard torch, because this one has a push button switch.



It is fully waterproof and even has anodised, abrasion resistant aluminium. It is shock proof and the clear globe cover is virtually breakproof. It has an adjustable beam, and comes with a spare globe in the tail cap. Supplied in a gift box with a tail lanyard and 2 x AA batteries. Length 172mm. A quality product that will give years of service. Replacement globes available Cat ST-3051 Pkt 2 $2.95.

Cat. ST-3050

Was $16.95 **May $10** **Save $6.95**

UHF Wireless Stereo Headphones

NEW in 2000

These new 433Mhz wireless headphones incorporate the latest RF technology to provide personal listening freedom with great sound. The older style cordless headphones were infrared IR, where you had to be in the same room and in line of sight. These new RF headphones change all that! RF goes through walls, floors and windows etc. and around the house. Up to 50mt. in clear line of sight and less of course, when going through obstacles - walls etc. •The sound quality of the headphones is very good and the adjustable ear pads are comfortable •Transmission mode : UHF Stereo •Frequency response :20Hz - 20,000Hz •S/N ratio :60dB •Channel separation: 30dB

Cat. AA-2000

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BY STEWART FIST

Exposure Standards

AS I'VE POINTED OUT BEFORE, the standards for exposure to EMF radiation is a hang-over from the 'thermal-only' theory that you can only cause damage to biological systems if you heat it by about four degrees Celsius.

We know that you get major breakdowns of cell function if the body temperature rises by four degrees in any animal, and animals begin to exhibit disturbed behavioural changes when body temperatures rise more than one degree.

So this was taken as the thermal-danger point, and exposure standards were devised around tests which could produce that one-degree rise. This is frequency-dependent of course, which always complicates standards-setting.

The first really comprehensive standards aimed at the cellphone problem was devised in 1991 by the American IEEE (Institute of Electrical and Electronic Engineers), and the committee which made that determination was led by Dr Om Gandhi, a specialist in radio dosimetrics (the measurement of radio absorption rates in the body).

It turned out that some of the new mobile phone classes had output power-levels which exceeded the old standards. So around the world various national standards groups took their lead from the IEEE, and either raised their levels, ignored the standards, or added a clause which said they didn't apply to hand-held devices.

Australia took the latter course initially. I can only assume that they believed that heating levels shouldn't apply to any transmitter held against the side of the head. We all have our heads cooked by the summer sun anyway, so possibly they thought that exceeding thermal limits wouldn't be a problem to Australians.

Later they set guidelines for the power-output of cellphones, but since Australian government regulators didn't have testing facilities capable of measuring GSM's pulsed-power, they left policing of the standard to the importers, on a promise that their handsets were within the limits.

One new problem encountered at this time was the use of time-division radio techniques. In GSM cellphones, the power is transmitted in short (one-eighth cycle) bursts 217 times a second, and in the American TDMA cellphones it is one-third cycles every sixtieth of a second.

When you pump out power in intense pulses like a strobe light, the average power output and tissue absorption becomes only one of the many metrics associated with likely health effects. You get low-frequency problems, harmonic problems, etc. as well, which can all effect biological systems.

Average power absorption might be directly related to temperature rises, but you've now also got to take into account the peak power. And in any low-frequency, pulsed-power environment, there will be some resultant coupling taking place between the handset, as a whole, and the head in close proximity.

In the early 1990s, the solution to this problem in setting standards was just to ignore it and concentrate on temperature levels. And it is these that became the 'accepted international standards'; these are the standards the cellphone industry maintains vigorously that its equipment conforms to.

In America, the ANSI (American National Standards Institute) accepted the IEEE's standards in 1992, and these spread around the world and became a de facto world standard.

Phantom heads

The primary measurement of head absorption in the last few years is called the SAR (Specific Absorption Rate), and this is now used as the key determinant of when biological tissue is getting too high a dose. It can't be accurately measured in humans, of course, but it can be calculated from measurements taken inside phantom heads (model heads with temperature probes). But each phantom head differs from the others, which is why scientists often made different claims about the 'actual' SARs.

The 'incident power-density' for transmitters are set by calculating a SAR of 0.4W/kg over entire body, or 0.4 W/kg for any one gram of tissue.

In an 'uncontrolled environment' they then reduced these figures to one-fifth and applied some variations for frequency and time used. This means that for cellphones at 800 to 900MHz, the peak power-density should be no more than 2.7mW/ cm^2, averaged over six minutes for a user, while for a bystander (uncontrolled environment) the limit was set at 0.53mW/ cm^2 averaged over 30 minutes.

In the new Personal Communications Services frequencies (1800 to 1900MHz — only now being made available in Australia) the permissible power densities were nearly twice as high. And in controlled environments (corporate applications mainly) there was also an exclusion clause for transmitters in the 450 - 1500MHz range where the radiated power is seven watts or less and the antenna is not right up against the side of the head (within 1 inch). This allowed the Iridium satellite phones with an extendable antenna to escape regulation.

Scientists have gradually revised and improved their phantom heads and began to measure localised tissue heating effects within the brain cavity with more accuracy. In the last few years Dr Gandhi has done a lot of work on the focussing effects of the skull and brain tissues, and, as he came to the conclusion that many 800-900MHz cell phones sometimes exceed the 1.6 W/kg per gm tissue absorption limit.

They don't exceed it by much, and obviously, not all the time, because the cellular base station turns the handset power up and down (240:1 power variance) according to the level of the signal it receives. But it is fortunate that the GSM manufacturers abandoned plans to sell mobiles with output power up to 20 watts back in the early 1990s, and kept them down to an average 1 watt.

Baseband chipset for GSM handsets

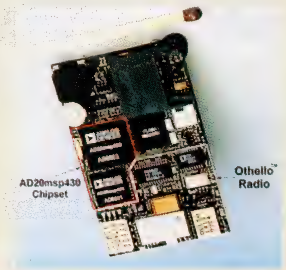
ANALOG DEVICES' AD20msp430 SoftFone chipset enables cellular phone manufacturers and end users to easily customise features and options, and incorporates significant advancements in power consumption, cost and size.

Analog Devices have introduced the world's first completely RAM-based baseband chipset for wireless handsets. The AD20msp430 SoftFone chipset, a next generation GSM baseband chipset, provides cellular phone manufacturers with the functionality to easily customise features and options entirely in software.

The SoftFone chipset allows designers to build applications, such as GSM mobile phones, PDA-type platforms and Internet appliances, which can accommodate 2.5G wireless data communications standards, including GPRS (General Packet Radio Service) and HSCSD (High Speed Circuit Switched Data), and are also forward compatible with future 3G cellular standards. In addition, the new SoftFone chipset incorporates significant advancements in power consumption, cost and size. A dual-band GSM/DCS-1800 phone can be implemented on a single-sided 20cm^2 printed circuit board.

The AD20msp430 SoftFone chipset completes the signal chain by complementing Analog Devices' Othello chipset, the industry's first, open market GSM direct conversion radio technology, announced in September 1999. With the SoftFone chipset, a complete dual-band signal chain can be accomplished in an area equal to one-half of the size of a business card. In addition, the SoftFone chipset provides an unprecedented 1000 hours of standby time, translating into six weeks before having to recharge a GSM-based device.

The SoftFone chipset is comprised of two chips: the AD6522 digital baseband processor, and the AD6521 advanced baseband converter which provides the interface to the radio, all audio functions, and all required auxiliary monitoring and control functions. The AD20msp430 SoftFone chipset is sampling now. High volume production will be available in August 2000. For more information, contact Analog Devices, Ray Stata Technology Center, 804 Woburn Street, Wilmington, MA 01887. Or visit their website at: **www.analog.com** ■



PSD from Waferscale

WAFERSCALE INTEGRATION has just introduced its new PSD4000 family. PSD4000 ICs provide external memory and logic to 16-bit microcontrollers and DSPs. The first devices, available now have 512KB of Flash, a second 32K Flash array for concurrent ISP, 8KB of SRAM and a 3,000 gate CPLD, plus an ISP JTAG port that allows ISP in 20 seconds or less. The largest PSD4000, due out in 2001, will integrate as much as 2MB in the primary flash array with 128KB of SRAM.

Adding external flash to 16-bit designs has historically required that the designer build an interface to the processor that requires several additional chips, including a CPLD or FPGA. Since all the logic for the interface, chip selects and pin assignments is built-into the PSD4000 family, no additional chips are required and the hardware design takes an hour or less to complete. The second flash array allows the code or data to be updated during system operation — a task that requires a second external flash device to if you don't use a PSD4000.

The first two members of the PSD4000 Series, PSD4135G2 and PSD4235G2, are available now in an 80 pin TQFP package. Prices for the PSD4135G2 (with 1,000 gates of logic) start at US$8.35 (10,000+). PSDsoft is available now for free from Waferscale's web site **www.waferscale.com**. A complete development kit including the FlashLINK Programmer and Development Board is also available for US$99.

AUSTCARE REFUGEE WEEK

Clearing a safe path to Freedom

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Jack O'Donnell, Managing Director

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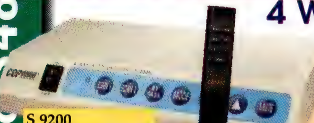
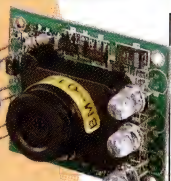


S 9200
Was $225, NOW
$199

Monitor up to 4 A/V channels with this advanced automatic A/V switcher. Any combination of the four cameras can be scanned and displayed on either of the two monitors, it switches both video and audio. The time and date is displayed on both monitors making it ideal for surveillance applications. The scan rate and duration of each camera can be configured using the on screen menu functions. (Includes remote)

PCB & Lens Cameras.



Using only a 3 wire connection, these mini cameras can be installed so they are virtually undetectable. 3 models to choose from.

S 9010
S 9011 with Audio
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All Only
$119

All models require regulated supply. (M 9449) $28.95

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Wide Angle Miniature Camera

Supplied with in-line BNC connectors for video and a DC Jack for powering the unit. Includes an internal regulator. *M 9272 Power Supply to suit $14.95*

Features:
- Simple to install • 3 Wire connection • Composite Video Signal Output • Small unobtrusive size
- 500 x 582 pixels • 380 lines• 12V DC Operation
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S 9001
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The Polestar Video Modulator

New in '2000

This video modulator converts composite video into modulated RF enabling a video camera and microphone to be connected to your television antenna system, making it ideal for use as a door monitor and one way intercom without the need for a dedicated CCTV monitor.

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S 9220 ONLY
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M 9449 Power Supply to suit $28.95

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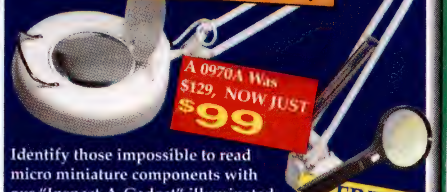

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Features • 3.5 Digits • up to 1000V DC range • 9VDC power supply • ± 0.5% (2 digit)

Q 0560 Was $45,
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Famous Micron Soldering Station

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Excellent for all general purpose and production soldering. **Features:** • High insulation ceramic heating element • Rapid heat-up and heat recovery • Heater insulation of over 100MΩ • Zero voltage circuit minimises high voltage spikes & magnetic fields to prevent damage to sensitive devices • Continuous temperature adjustable from 250° to 430°C • Grounded power cord • Selecting the desired operating temperature is as simple as turning a knob.

Supplied with Long-Lasting Iron Clad Tip

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+ T 1300 Solder Roll Holder +T 1100A
Solder with the first 30 T 2441's sold (RRP VALUE$35.40)

32 Range DMM + Temp

Featuring an extra large display, this multi-function meter hosts all the usual functions as well as a transistor tester, capacitance up to 2000pF, continuity/diode test, temperature and frequency counter up to 20kHz.

Q 1066 Was $89,
NOW ONLY
69.95

Includes Holster & Temperature Probe! Ideal meter for students, teachers, tradesmen, etc.

120W Gas Soldering Iron Kit

SOLDERING GRUNT TO GO!!

"This has all the convenience features of a normal gas iron, such as quick heating, no power cords, light weight and best of all, it comes with a blow torch tip."
Silicon Chip Mag, Sept '97

The T 2601 kit comprises of a 120W Gas Soldering Iron PLUS a handy carry case with a range of tips and accessories including cleaning sponge, solder dispenser, blow torch, hot air blower and hot knife cutter.

T 2601 Was $149 ,NOW $129

MASSIVE 120W Heat capacity! Simp "thumb-start" piezo ignition refillable ga storage!

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***Features:** Auto ranging • EF Detect • Data Hold function • Temperature • AC/DC Voltage 250mV–750V • AC/DC Current 250µA–10A • Resistance 250Ω–25MΩ • Diode Check & Buzzer • Optically Insulated RS232 Interface (Q 1082)*

*The Brymen® **Q 1080** digital multimeter is truly an amazing piece of test equipment with features only found in meters 2 or 3 times the price! One of the handiest features is the EF function, in short, this function will enable the user to detect 240VAC mains without even connecting a single test lead!*

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with 6.5kV transient protection!

Q 1080
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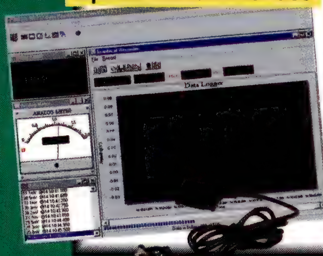

Q 1082 Optically Isolated RS232 Interface

This interface is perfect for converting your Q 1080 into a fully fledged Data Logger. It is very simple to setup and use with any PC running Windows 95/98. A unique feature of the kit is the optical interface which ensures the Q 1080 and PC it is connected to do not fail in the event of either device becoming faulty.

Q 1082 RS232 Interface $25

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23 Range Digital Multimeter

This compact meter will easily slip into your pocket, it's great for anyone on the move, or alternatively for a students toolkit. Includes an audible continuity buzzer, Transistor Tester, Diode Tester, 'K' type thermocouple, and square wave test output. Measures DCV to 1000V, DC Amps to 10A, ACV to 750V, resistance to 2MΩ and temperature from -40°C to 250°C. All this plus a HOLD function for this tiny price!

Q 1059 Was $32.95,
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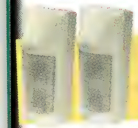
ALTRONICS

6 Sector Alarm System

Features: • Separate Keypad and Control Unit • Keypad suits standard 2 gang wallbox or surface mount block • Programmable Master code, Client Code and 8 user codes • All user codes are equipped with Duress Function • Programmable Zones • All zones can be configured for single or multiple triggering • Full memory of alarm events • Programmable entry / exit delay and alarm duration • Programmable response time for each zone • Exit/ entry beep enable / disable options • Instant arming codes for home or away options • Provision for arm / disarm with up to 3 remote keyswitches • Power watchdog resets the system before the battery is exhausted • Non-volatile memory • Connection for remote Siren, Strobe • Built in dynamic battery charger and tester • Battery condition can be checked manually or automatically • AC/DC Operation • Battery backup capable • 12 months warranty

S 5260 6 Sector Panel
ONLY
$249



SECURITY SAVER DEAL !!

Purchase the 6 sector alarm panel and a S 5309 Dual detection PIR for $299 , and receive a second S 5309 PIR absolutely FREE!!! That's $55 Extra Value.

Inductance & Capacitance Meter

An essential piece of test equipment for designing crossovers, power supplies, RF circuits, etc.

- **3.5 Digit LCD Readout**
- **Diode & Continuity Test**
- **Auto Power Off**
- **Shock-proof rubber holster**
- 20μH-20H Inductance Range
- 200pF-20,000μF Capacitance Range
- Continuity Buzzer
- Diode Check
- Individual zero adjust for capacitance & inductance range

Q 1150 WAS $109,
NOW **$99**

SAVE 20%!!

150W Active Sub-Woofer Module

The inclusion of this sub-woofer will enhance any existing sound system and add a touch of realism to any home theatre sound system.

This completely self-contained amplifier module simply fits into the back of a sub-woofer cabinet. The unit will automatically spring into life from it's Standby mode once a signal is received. The Volume and Crossover Frequency Controls together with the Phase Correction Switch allows the sub-woofer to be set for a desired sound. Installation can be completed in just minutes.

50 Only at this drastically reduced price!

A 2450 Was $275,
NOW ONLY
$199

Features: • Auto Power On/Off with signal presence • Compact design • High & Low Level Inputs • High Level Outputs • Volume Control • Short Circuit Output Protection • Active Crossover variable from 50Hz - 150Hz • Phase Correction Switch • Power On Indicator • 240V Operation

PECC Bass Drivers

If you like your bass loud, these 8Ω bass drivers are for you. They feature poly emulsion coated cones (PECC) with rubber surrounds, low Q and high efficiency. Manufactured exclusively for Altronics, to our own specifications, these drivers are ideal for subwoofer enclosures in Hi-Fi, Home Theatre or Car Audio systems.

AMAZING VALUE!
Perfect for hi-fi or car audio subwoofers!
SAVE 40%!!

	Was	NOW
C 3022 165mm (6.5") 60W	$45	$29 ea
C 3024 200mm (8") 100W	$64	$45 ea
C 3030 300mm (12") 160W	$155	$89 ea

Dual Detection PIR

Features: • Double twin optics for improved detection • Automatic temperature compensation • Compatible with many standard alarm systems • Vertical adjustment for detection angle • Normal or Pulse count modes

New Improved Detection Technology!

Alarm systems with standard P.I.R's are prone to false triggering. The S 5309 features double twin optics which reduces the number of false triggers, all at the price you would expect to pay for a standard P.I.R.

S 5309 ONLY **$55**

UHF Remote Control Switch

This little gadget can easily be used to create a very simple panic alarm, remote lighting control or to control any other item you may wish to operate remotely.

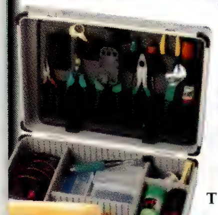
Ideal for controlling your lights, garage doors, etc

Operates in 3 modes: • **On/Off** The contacts are switched alternately, • **Momentary** The contacts are held closed while the button is held down in the momentary mode. • **Panic** The button must be held down for 2 seconds to operate the relays and also trip the transistor output.

Features: • **Latching/Non-latching Contacts • 2 Relay & 1 Transistor Outputs • Code Hopping • Audible confirmation • Incorporates handy key ring • 387 billion combinations • 30m operating range (open area) • 24 V DC 1 Amp contacts**

A 1018 Was $110,
NOW **$99**

Aluminium Case



This quality aluminium tool case measures 460 x 325 x 150mm.

Features all aluminium side panels, unlike others around which have plastic panels!

T 5020 **$65***

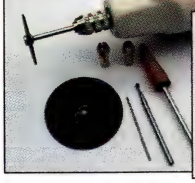
***Tools in case not included**

THIS MONTH ONLY!!

A Q 1053 19 Range DMM
valued at $19.95 *FREE* with every purchase of a T 5020 Aluminium Tool Case

MINI DRILL KIT

Great for drilling PCBs, polishing, or engraving.



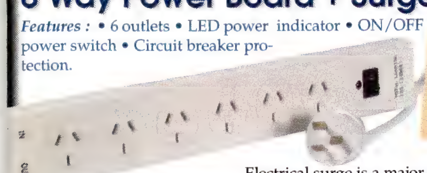
Includes two cutting disks, sand paper sleeve, engraving bit, four chucks and a PCB drill. A powerful high speed 12VDC motor will easily handle any task.

T 2303 **$29.95**

6 Way Power Board + Surge Protector

NEW in '2000

Features : • 6 outlets • LED power indicator • ON/OFF power switch • Circuit breaker protection.



Turn one GPO into six and protect your valuable equipment at the same time!

P 8140 6 way mains filter
ONLY **$35.95**

P 8150, 6 way mains filter + Tel. protector
ONLY **$44.95**

Electrical surge is a major cause for home appliance breakdown. This surge protector eliminates spikes from the 240VAC mains supply, saving your household appliances. Suitable for any standard 10A GP outlet. The P 8150 model also has standard telephone connectors enabling you to protect your telephone.

NEW KITS

DIGITAL VOLTMETER

NEW in '2000

(SC Feb. '2000) Keep tabs on your car's battery condition. See website for full details.

K 4338 **$34.95**

RCD TESTER

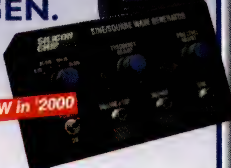
NEW in '2000

(SC Feb. '2000) Safely test the operation of a Residual Current Device. See website for full details.

K 6040 **$14.95**

SINE/SQUARE WAVE GEN.

(SC Feb. '2000) Generate sine/square waves with this audio waveform generator.
See website for full details.



NEW in '2000

K 2549 **$44.95**

ACTIVE MASTHEAD AMPLIFIER

(EA Jun. '98) Improve your TV reception .
See website for full details.

K 1795 Was $39.95 NOW **$24.95**

Fantastic Savings!!

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**12 months minimum warranty: 12 months from date of supply. Goods becoming faulty in this period should be returned to our premises with evidence of purchase and $6 money order, cheque or stamps to cover return postage.

Standard Delivery & Packing Charge: $5.00 to 500gms, $6.00 500gms-1 kg, $9.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

*Overnight Jetservice: Up to 3kg is $9.50, 3kg to 5kg is $16.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

American Express Cards Welcome

We welcome ... bankcard MasterCard VISA Diners Club International*

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs.

Insurance: As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance".

Altronics Resellers: Chances are there is an Altronics Reseller right near you—check our catalogue, phone us for details of the nearest dealer. An up to date reseller listing is available at our internet site at www.altronics.com.au 24 hours a day.

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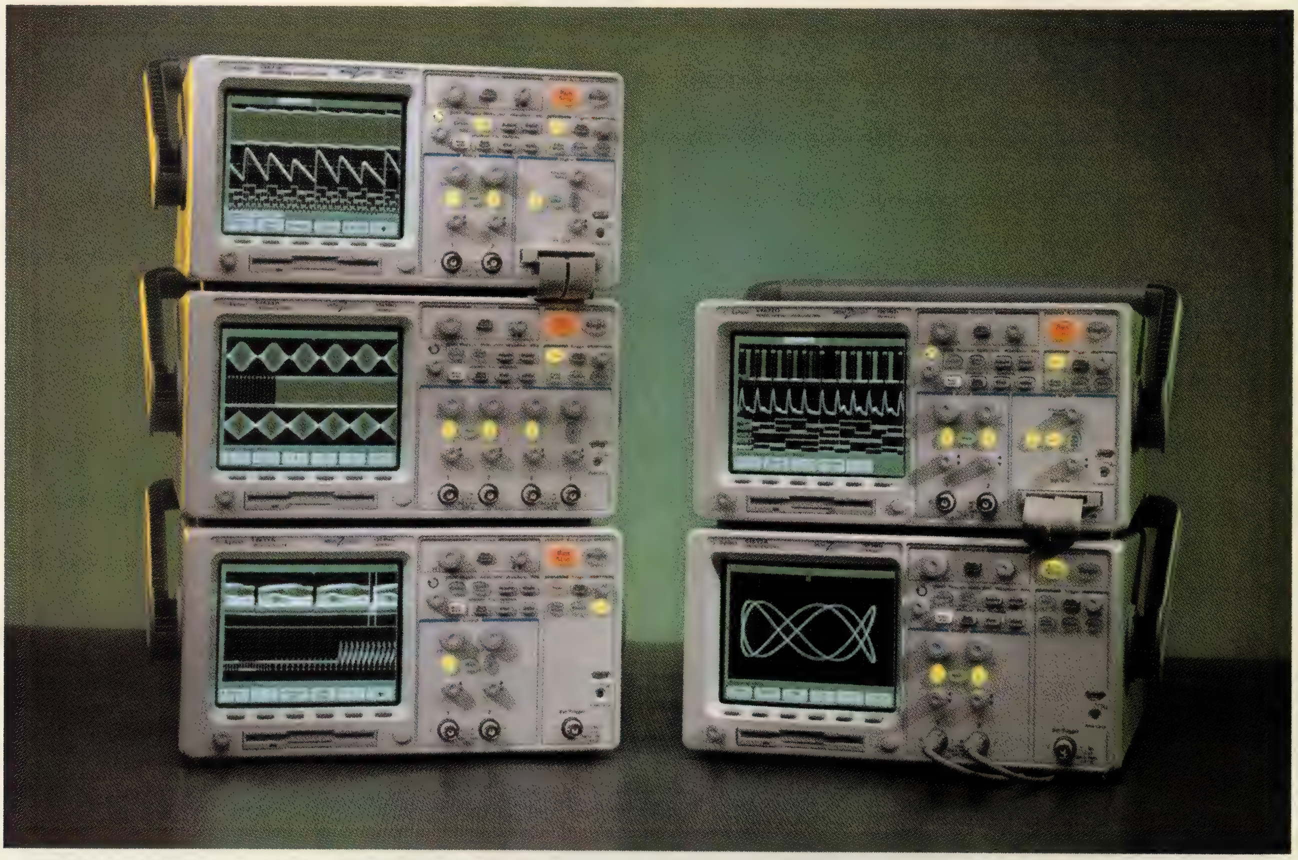


AGILENT REVAMPS POPULAR SCOPES

AGILENT TECHNOLOGIES, the $8 billion company formed from the original Hewlett-Packard test and measurement, medical equipment and components divisions, has announced a major update and enhancement of its very successful 54600 series of oscilloscopes. The new series consists of five models, all offering significantly upgraded features and facilities compared with the models they are replacing.

The Agilent 54600 series now offers more powerful multiple-channel configurations. There are two dual-channel models (54621A and 54622A) with 60MHz and 100MHz bandwidth respectively; one four-channel 100MHz model, the 54624A; and two models (54621D and 54622D) combining dual analog channels (60MHz and 100MHz bandwidth respectively) with 16 integrated digital channels, for more efficient work in the mixed analog/digital circuitry that is now so common in modern electronics.

The new models combine a maximum sampling rate of 200MS/s (much higher than the earlier models) with a fixed 2MB of deep 'MegaZoom' memory per channel, allowing the maximum sampling rate to be maintained down to lower sweep speeds — and also storing much more data, at high resolution. The Megazoom facility allows fast expansion at any time (even after single-shot capture) to inspect waveform details.

Another major feature of the new scopes is a significantly enhanced high-definition display system, which provides what Agilent claims is unsurpassed horizontal screen resolution, plus the ability to map deep memory into 32 levels of gray scale at up to 25 million vectors per second. This combination enables users to view and understand complex signal details, with confidence. It also greatly decreases the chance of missing a narrow, occasional transient, or overlooking a glitch or distorted edge that impacts circuit operation.

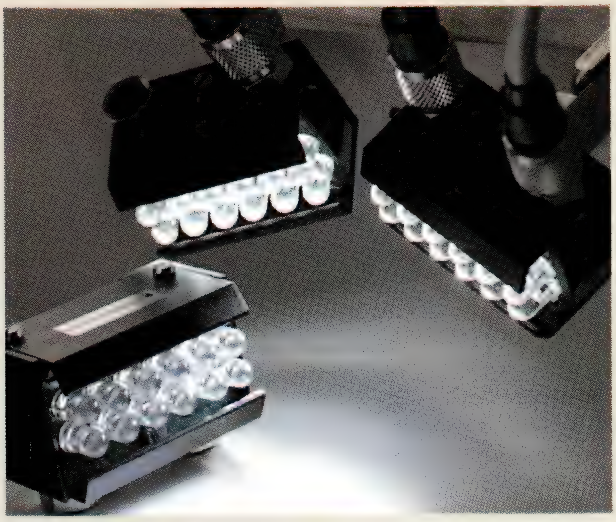
The new 54600 series also feature powerful enhanced triggering capabilities, including triggering on a specific edge, pulse width, pattern, sequence, TV line, and I^2C (Inter-Integrated Circuit bus) event. All of which allow designers to isolate and analyze complex signals and conditions common to mixed analog and digital designs, with greater ease.

"Mixed analog and digital signals sit at the core of more than 70% of new product designs today", said Mark Lombardi, product manager for the Agilent 54600 series. "Design engineers have quickly discovered that the two-channel scope — their instrument mainstay for years because of its familiarity and low cost — may lack the sufficient channels, memory or triggering needed to support the viewing of combined analog and digital signal designs."

Further features of the new Agilent oscilloscopes include an RS-232C interface, parallel printer port, floppy disk drive and FFT processing built in as standard. A GPIB interface and a full range of high performance probes are available as options.

Further information on these products may be found on the Web at **http://www.agilent.com/find/MegaZoom**, by contacting the Agilent Technologies Sales and Solutions Team on 1800 629 485 or by email to **info_tmo@agilent.com**. (J.R.)

• •



VarioFlash

THE IMAGING SOURCE Europe has announced the release of its modular LED lighting system for industrial image processing: the VarioFlash. Their web site contains detailed product information on the modules, and can be found at;
http://www.theimagingsource.com/prod/link/dlivarioflash.htm. ■

For MULTIMETERS from under $100,

Model 132
☑ 3200 count
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☑ 10A fused

or with special features like frequency or dB,

Model 8042N
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Fluke 87/89
☑ ± 0.025%
☑ Logger
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All meters have relevant IEC Safety Conformance Rating

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Model 2606
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☑ Vtrms

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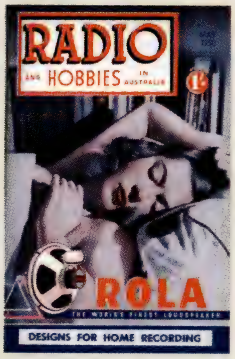
HISTORY & CROSSWORD

Published since 1922, **Electronics Australia** is one of the longest-running technical magazines in the world. Here are some interesting items from past issues:



50 YEARS AGO

Our front cover. Although soundly asleep, actress Maxine Sheppard is memorising lines for a new show.

EXPERIMENTS have been made at the University of North Carolina with an electrical brain wave machine - the electroencephalograph - which shows three basic patterns given off by the brain. These are short, sharp, slightly irregular waves of a high frequency during deep thought, tall relatively uniform-sized waves, cleanly and evenly spaced during relaxation, and rambling, rounded off waves of no fixed order during sleep.

This device allowed the first step to be taken - that of recognising brain behavior during sleep. The next was to devise a method of communicating with the brain in this state without waking the "patient."

It uses a very small pillow type loud-speaker, which repeats over and over again the matter to be learnt. In an experiment conducted to test the idea, some students were subjected to a verbal barrage of words to be learnt in waking hours. Those so subjected learnt the words much quicker than those who were not.

25 YEARS AGO

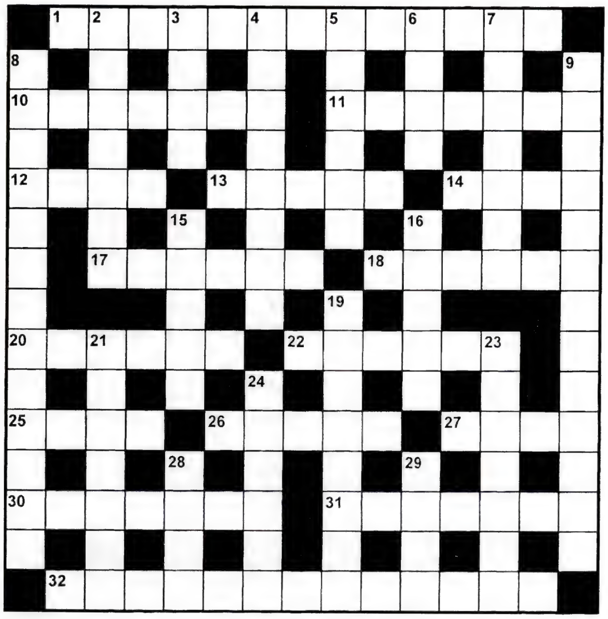
Flat screen video: An experimental flat-screen video system that transmits handwriting, reproduces pictures, and can be used to communicate directly with a computer has been demonstrated by scientists at Bell Telephone Laboratories, Holmdel, New Jersey.

The system consists of a commercially available plasma panel display (modified by Bell scientists), electronic control circuitry, and a special pen called a light pen. Plasma panels are made up of thousands of tiny neon-gas cells arranged in vertical and horizontal rows. These cells glow when energised by an electric current.

Push-button dialler: The Australian Post Office has approved a new telephone number dialling device that provides push-button dialling. It is based on the latest MOS-LSI technology and adds the speed and convenience of press-button dialling to an ordinary rotary dial telephone.

It features a "try again" facility at the press of a button, and a memory in which the 10 most frequently used numbers (up to 18 digits long) can be stored. Any of these numbers can then be called automatically simply by pressing the appropriate button.

The unit is used with a normal telephone, and requires no internal modifications to existing telephone equipment. It is expected to win widespread acceptance in Australian business commerce, and even in private homes. ■



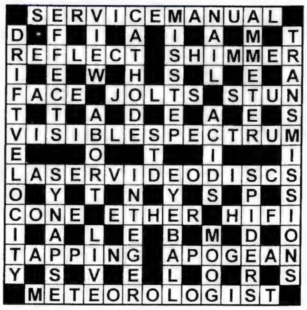
ACROSS

1 Said of integrated devices. (13)
10 Heavy metal. (7)
11 Flat region. (7)
12 Fundamental physical property. (4)
13 Basis for circuit. (5)
14 A slight tinge of colour. (4)
17 Generator of dynamic electricity. (6)
18 Place where power, or a signal, is available. (6)
20 Temporary charge storage device. (6)
22 Domed cover over an antenna. (6)
25 Motion of air at an electrified point. (4)
26 Metric prefix indicating hundredfold. (5)
27 A computer could be on top of this. (4)
30 Part of a spacecraft system. (7)
31 Incorporated as an integral part. (5-2)
32 Said of a certain type of switch. (13)

DOWN

2 Not set for effective operation. (7)
3 Activate a starting switch. (4)
4 Extremely small unit of current. (8)
5 Units used for comparing scalar values. (6)
6 Distort TV picture. (4)
7 From one extreme to another. (7)
8 Flip-flop. (13)
9 Technique where separate recordings are combined. (13)
15 Common keystroke on computer. (5)
16 Personal teacher. (5)
19 Grounded conductor. (5,3)
21 Short-take-off military aircraft. (7)
23 Prefix frequently used in this magazine. (7)
24 Prepare - not for landing! (4,2)
28 Prefix of electrostatic units. (4)
29 Elevator. (4)

April Solution



■	S	E	R	V	I	C	E	M	A	N	U	A	L	■
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R	E	F	L	E	C	T	■	S	H	I	M	M	E	R
I	■	E	■	W	■	H	■	S	■	L	■	E	■	A
F	A	C	E	■	J	O	L	T	S	■	S	T	U	N
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V	I	S	I	B	L	E	S	P	E	C	T	R	U	M
E	■	■	■	O	■	■	T	■	■	I	■	■	■	I
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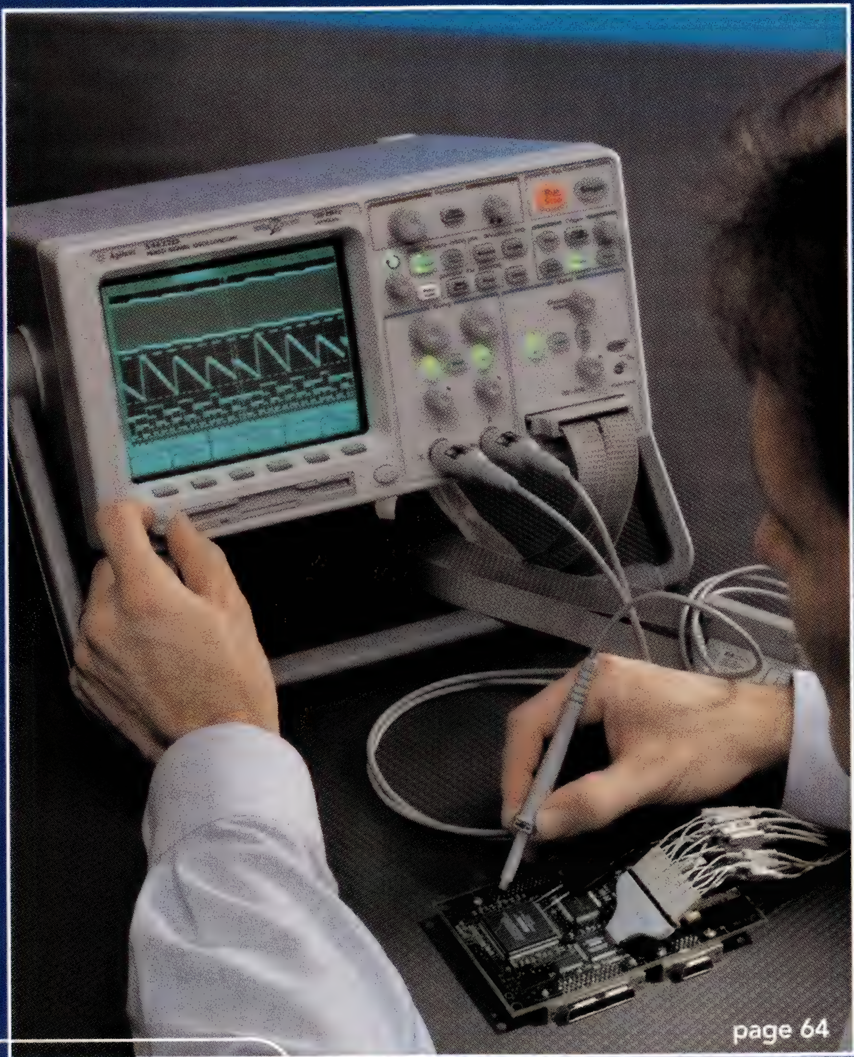
T	A	P	P	I	N	G	■	A	P	O	G	E	A	N
Y	■	S	■	V	■	E	■	L	■	O	■	R	■	S
■	M	E	T	E	O	R	O	L	O	G	I	S	T	■

Professional *electronics*



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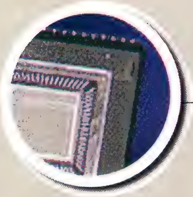

SILICON **VALLEY**

NEWS

IN BRIEF

■ French IC design company Bureau d'Etudes Vision (BEV) has announced a potentially revolutionary 'visual processor', a chip that can see by mimicking the function of the human eye. The so-called 'Generic Visual Perception Processor' (GVPP) can compute 20 billion instructions per second, allowing it to do everything from making cars safer to selecting ripe fruit. BEV claims the chips can be mass-produced for as little as US$6 per chip.

■ IBM has launched a new type of memory chip technology known as 'double data rate' (DDR) and delivering twice the amount of information to the microprocessor as conventional DRAM memories.

DDR chips could play a key role in easing the huge gap that has developed between the microprocessor's ability to process data and the system memory's ability to deliver it.

■ Hitachi america's semiconductor equipment group has announced it is expanding its operations to handle the growing demand for chip-making tools. The unit is building a new 72,000 square feet semiconductor equipment plant in the Dallas suburb of Irving, in Texas.

Demand for all chip-making tools has been increasing sharply in the past year after a four-year recession. Some 160 people will be employed at the new facility, which will be completed in early October.

New FRAM development

RAMTRON INTERNATIONAL (originally an Australian startup) and Japan's Fujitsu have announced development of a new class of 'FRAM' memory chips using new ferroelectric non-volatile technology that allows the chips to retain data after power is turned off. The FRAM ICs use a one-transistor/one capacitor memory cell design that substantially lowers the cost of making non-volatile memories.

The first of the new FRAMs will have a storage capacity of one megabit. Fujitsu, which is paying Ramtron a US$2 million licensing fee, will produce and market the chip that can be used for a broad range of devices, including portable, hand-held electronic devices, smart cards, electronic power meters, test instrumentation, factory automation, security systems and other applications.

"We anticipate that this market will grow to more than US$10 billion by 2005 and Fujitsu is targeting to be the major market supplier of these advanced semiconductor devices", said Kazunari Shirai, electronic devices group president for Fujitsu.

66 Iridium satellites may burn

IN WHAT MAY BE a stunning conclusion to one of the most spectacular business debacles ever, Iridium may soon fire up the engines of its 66 orbiting communications satellites, sending them plunging to a fiery crash in the upper atmosphere over the earth's oceans. The company was unable to find a buyer for the operation, which provides wireless telephone services to any point on the planet.

Iridium was already set to shut down the satellites in March. They cost around US$7 billion to build and put into orbit, and are currently circling the Earth at around 485 miles. One by one they will be directed into a rapidly decreasing orbit, to burn up on impact with the upper atmosphere.

Analysts said getting rid of the 1460-pound Iridium satellites may be the best way out. The company simply launched the wrong kind of service at the wrong time. Land-based wireless communications services reach almost as far into the outermost fringes of the world as Iridium. Their services cost a fraction of the Iridium charges, and unlike the bulky US$3000 Iridium sets, regular wireless phones are compact and are starting to offer Internet and other services that exceed the abilities of Iridium.

Intel crosses 1GHz barrier too

UNDER HEAVY PRESSURE to match Advanced Micro Devices' achievement of shipping a 1GHz microprocessor, cross-town rival Intel announced it too had begun delivering Pentium III processors operating at just over 1GHz. In an unusual move Intel also went on the offensive against AMD, claiming the company's 1GHz Athlon chip barely outperforms Intel's 800MHz processor.

Intel also said its 1GHz P-III is 15% faster than AMD's chip, because the Pentium chips have a faster cache memory. AMD's cache operates at about one-third the speed of the CPU and is located on a separate chip. Intel's Level III cache runs at 1/2 the clock speed and is integrated onto the PIII processor. "We didn't get to be first with our news release, but we are confident that we have the fastest product on the market", said Intel spokesman Michael Sullivan.

AMD officials didn't dispute the Intel claim, but the company said it first needs to obtain a copy of the Intel processor to run performance comparison tests to verify Intel's claims. "We have had a difficult time getting a one gigahertz Pentium III in order to make a fair comparison", said an AMD spokesman.

In another surprise, Intel, whose top-of-the-line processors typically cost more than AMD's chips, priced its 1GHz processor at US$990 in quantities of 1000. This is $309 less than AMD's 1GHz Athlon. Analysts said the move is clearly designed to put a damper on AMD's 1GHz party, as the company will be forced to reduce its $1300 price.

IBM's Linux supercomputer

IBM HAS ANNOUNCED the development of a new class of 'Los Lobos' low-cost supercomputers that use the Linux operating system and low-cost PC hardware.

The Los Lobos system is a 'supercluster' of servers that manage networks of other computers. The first of the machines will be located at the University of New Mexico, the first of six US universities to install the system. The Los Lobos system will consist of 256 IBM Netfinity PC servers, which are linked together and provide supercomputer-level performance at a historically low cost.

"The Linux superclusters are the new supercomputers of the 21st Century", said Frank Gilfeather, the University of New Mexico's director of supercomputing. "We see them as replacing the traditional Cray, IBM and Silicon Graphics supercomputers because of their cost benefit."

The combination of low-cost PC servers and a free Linux OS will enable researchers and developers to get access to machines with processing power of systems they could not otherwise afford.

The use of Linux is a huge boost to the credibility of the upstart OS. Microsoft has tried hard to project Linux as an OS that doesn't have much functionality beyond the needs of hobbyists and small companies, but the Los Lobos project clearly shows Linux is ready for sophisticated enterprise applications in the corporate market. ■

generator

THIS MONTH:

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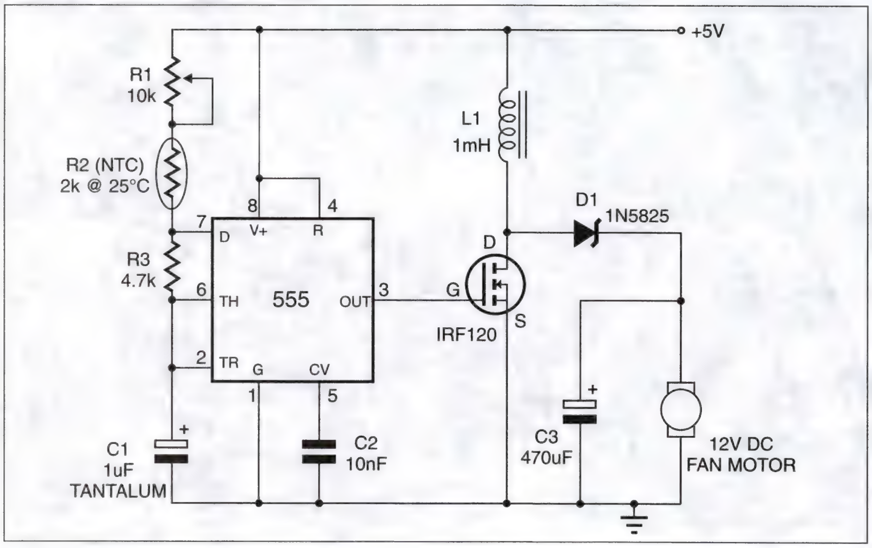
CIRCUIT & DESIGN

Cooling Fan Controller Saves Power

PORTABLE FIELD equipment is often fitted with a fan to circulate cool air past heat sinks and high wattage resistors, etc. The equipment generally operates on rechargeable batteries, and it would be helpful to conserve battery power by regulating the speed of the cooling fan according to the ambient temperature — that is, a lower speed at a lower internal air temperature. The simple controller circuit shown here performs this function, and consumes very little power.

The heart of the circuit is a 555 timer configured as an astable multivibrator, where one of its timing resistors is a negative temperature coefficient (NTC) thermistor. The thermistor is mounted inside the cabinet in the outlet air stream from the fan, or at any other point where temperature needs to be monitored. With the components values shown, the 555's oscillating frequency is about 100Hz at 25°C. The thermistor's characteristic is quite linear over the temperature range of interest, but resistor R1 can be used to trim the frequency and therefore the speed of the fan.



As the temperature inside the cabinet falls, the resistance of the thermistor (R2) increases, lowering both the oscillator's frequency and duty cycle. The 555's 5V output is used to derive a DC voltage by switching a 1mH coil (L1) via the IRF120 MOSFET. The high amplitude pulses generated at the MOSFET's drain (due to Ldi/dt generated in the inductor) are rectified by a 1N5825 Schottky rectifier diode then filtered by a 470uF capacitor. The MOSFET should be mounted on a heat sink.

The resultant voltage varies from about 10V to about 5V as the temperature decreases, and is used to drive a 12V DC cooling fan. Its speed is lower when less cooling is needed, so this conserves power in portable equipment that operates on batteries.

Mr.V.Lakshminarayanan
Bangalore, INDIA ***$30***

THIS MONTH'S WINNER!

Smarter blown-fuse indicator

THIS CIRCUIT is an adaptation of a well-know circuit which turns on a LED to indicate a blown fuse.

The original circuit (Fig.1) simply has the base of the PNP transistor tied to the positive side of the output, via R2, which assumes that the demise of the fuse is due to a short circuit. That is, an unplanned path to earth has occurred and the positive rail is held permanently at earth (0V) potential, thereby turning on Q1 and the LED via R2.

This is reasonable, except that I have the occasion to design a logic circuit for power regulation where it is possible for the circuit to fail and draw sufficient current to blow the fuse, but the nature of the circuit means that after failure parts of the logic circuit could return to very near full potential, if fed by R2. This in effect leaves the base of Q1 tied to the logic circuit, which then turns on, and off, and on...

The design shown in Fig.2 turns on the LED, and holds it on. Importantly, R2 doesn't continue to feed the logic circuit, which is pertinent where the logic may control large currents or high-powered circuitry. Note that the standing voltage drop across D1 must be less than is needed to bias Q1 on, and the resistor values will depend on the voltage of the supply.

Stephen Butcher
Masterton, NZ
$25

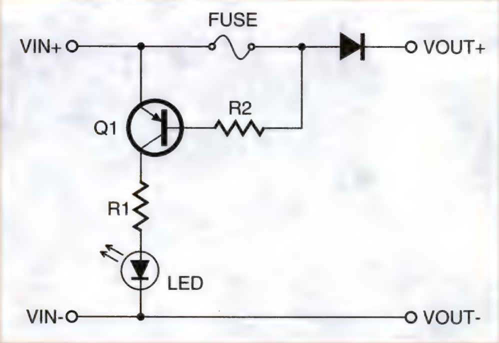


Fig.1

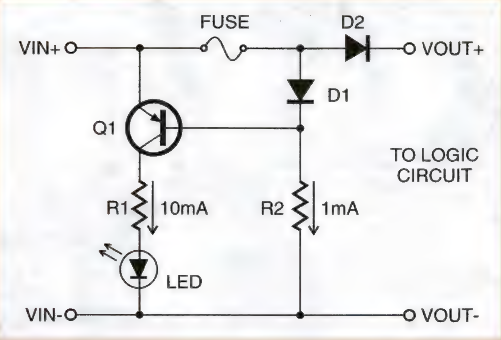


Fig.2

IDEAS

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Win our 'IDEA OF THE MONTH' Prize! Valued at $469!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a Video Inspection Capture System from Allthings Sales & Services, which consists of a colour CCD camera, close-up lens set, adjustable stand and lamp, PCI video capture card and software, plus video cable and two plugpacks. You can find out more about this great system at the Allthings website; www.allthings.com.au.

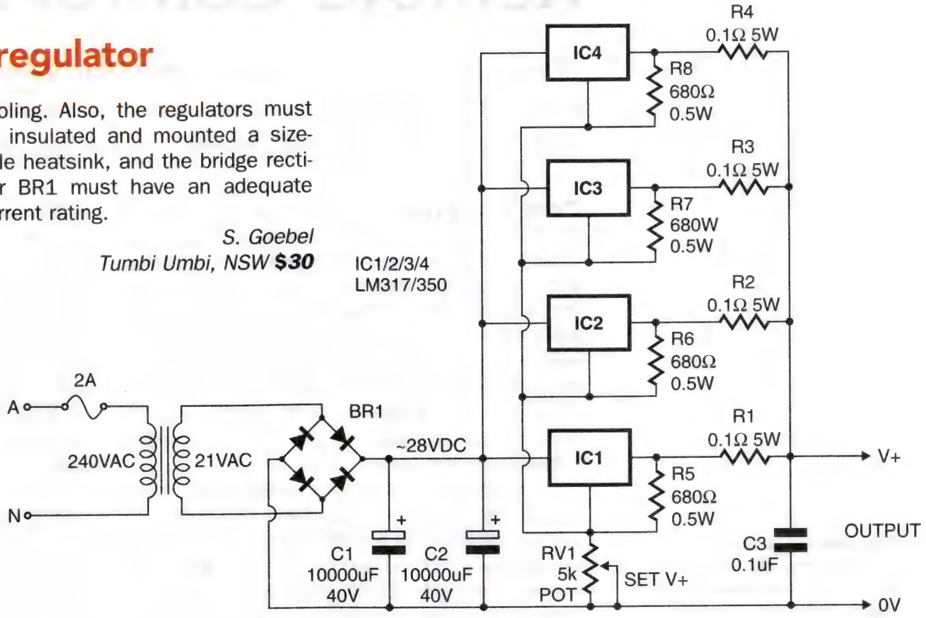
Low-cost, high-current regulator

THIS ADJUSTABLE power supply circuit is designed for a high current output, and is based around the popular LM317/350 positive regulator.

The transformer steps down the mains voltage to 21 volts AC, where the voltage is rectified by BR1 and filtered with C1 and C2. This gives a DC level of about 30V, which is fed to four LM317 regulators, IC1 to IC4. Here, the supply's output current capability is vastly increased by hooking up the regulators in parallel via 0.1 ohm current sharing resistors, R1 to R4. Pot RV1 adjusts the supply's output level by setting the voltage at the regulator reference legs.

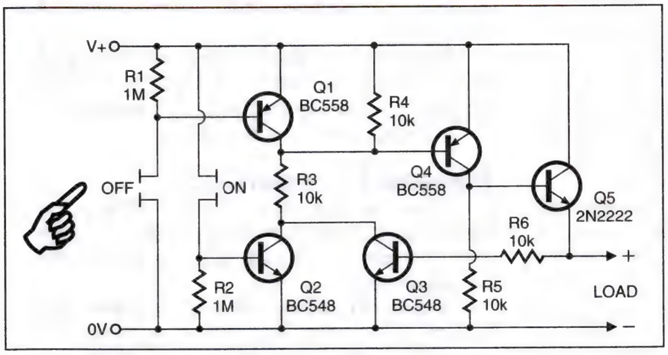
Note that the output resistors should be mounted 20mm or so above the circuit board to assist cooling. Also, the regulators must be insulated and mounted a sizeable heatsink, and the bridge rectifier BR1 must have an adequate current rating.

S. Goebel
Tumbi Umbi, NSW ***$30***



IDEAS FOR EXPERIMENTERS

Versatile latching touch switch



THIS CIRCUIT was originally designed for use as a calculator on-off switch where the mechanical equivalent was unreliable, but it could be used in other applications where a supply-voltage tolerant, reliable and robust touch switch circuit is needed.

The circuit layout is not critical, the switch will operate with a supply from +6V to at least +15V, and current consumption in the OFF state is virtually zero. Note that the touch contacts are cross-connected so that one side of the ON set is V+, and one side of the OFF set is 0V.

Assuming the circuit is in its OFF state (where all transistors are off), a finger across the ON contacts will turn Q2 on, which then turns on Q4 and Q5 via R3. The high at the output (emitter of Q5) then turns on Q3 via R6, which latches the circuit in the ON state by holding the collector of Q2 low.

Touching the OFF contacts then turns Q1 on, which shuts off Q4 and Q5. The load pulls the output low, which in turn shuts off Q3, removing the previous latching action at R3. Note that Q1 and Q2 only conduct while their matching contacts are bridged. ■

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BY JIM ROWE

2/4 Channel UHF Remote Control System

Here's an elegant new design for a UHF system which uses a small keyfob transmitter, and offers either two- or four-channel control plus reliable drift-free operation at 433MHz. It's also low in cost and very easy to build.

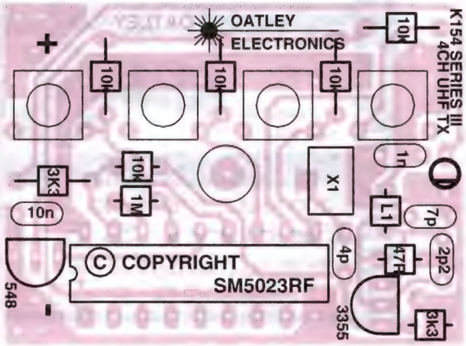
MORE THAN EVER, there seems to be a need for people to achieve control of electrical or electronic equipment remotely — albeit over relatively short distances, say up to 20m or so. This includes operation of garage doors and electric gates from inside a vehicle; enabling and disabling vehicle and/or property security systems from the outside; switching pumps or lights on and off from elsewhere on a property; controlling the volume level of a sound system from a different room; controlling model trains or toys; and so on.

Many of these jobs are performed best using a radio-linked remote control system, and preferably one that operates at a relatively high frequency so the antennas needed can be as small and unobtrusive as possible. Luckily it's now possible to do this very well with systems that also have another worthwhile advantage: they are readily available in low cost, assemble-it-yourself kit form.

Sydney kit firm Oatley Electronics has developed a number of these systems in recent years, and understandably they've been very popular. So much so that the Oatley team has now been encouraged to develop another one, which takes advantage of both newly available components and their own experience with the earlier designs, to deliver better performance while also being even easier to build and set up.

The photo below *shows how the transmitter fits inside the keyfob case, along with the miniture 12V battery.*

Bottom: *The component overlay for the transmitter: don't forget to solder in the SAW Resonator on the other side of the board.*



As you can see from the photos the new 'Series III' designs team up a new four-channel transmitter unit, housed in a very compact 'keyfob' case, with either of two receiver boards. One of the receiver boards provides for two control channels, while the other provides four channels. So you can build up either a two- or four-channel control system simply by selecting the appropriate receiver boards.

An important feature of the new transmitter design is that it uses a SAW resonator to establish the 433MHz oscillator's carrier frequency, giving very close to crystal frequency stability and simplifying oscillator setup. Similarly both of the receiver boards use a pre-assembled and pre-aligned crystal locked superhet UHF receiving module, which again gives high stability — as well as removing the need for any user tuning alignment.

Another feature of both the transmitter and receivers is that they use improved security encoder and decoder chips: the SM5023RF encoder in the case of the transmitter, and the matching SM5035RF-M4 for the receivers. These chips allow each system to be wire-link programmed with any of 6561 (3^8) different security codes, for excellent reliability and protection against interference — either accidental or deliberate.

Both the two- and four-channel receiver boards operate from 12V DC and allow each control channel to be set independently for either toggling or momentary operation of its output relay, when the corresponding button is pressed on the transmitter. The output relays also have contacts rated at 4A, so they should be suitable for switching many different kinds of load circuit.

The boards are also provided with plenty of indicator LEDs, so that it's always easy to see the status of the system itself, the receiver section and each channel's output.

Transmitter operation

As you can see from the schematic of Fig.1, the transmitter circuitry is relatively simple — most of the complexity is inside IC1, the SM5023RF security encoder.

Transistor Q1 forms the UHF oscillator, with its frequency set to 433.92MHz by SAW resonator X1. Inductor L1 is used to 'peak' the oscillator activity for best output, and also functions as an antenna. It consists of a small air-cored coil plus the inductance of the adjacent PCB tracks.

The oscillator is effectively turned on and off by a serial binary control signal from pin 17 of the SM5023RF encoder chip, and this is how the control codes are actually transmitted. When pin 17 is high ('1') the oscillator receives base bias and operates, generating UHF; on the other hand when the output of pin 17 is low ('0') there

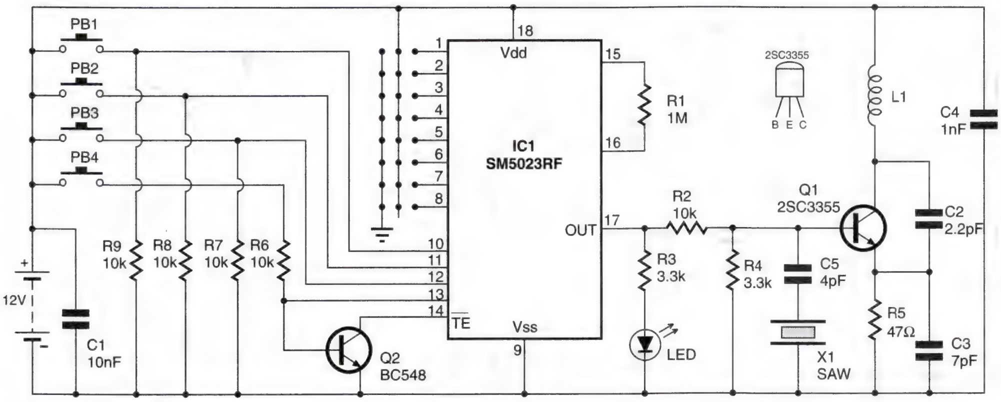


Fig.1: *One chip does it all! The transmitter can handle up to four channels, with inductor L1 acting as an antenna.*

is no bias and the oscillator stops. So the transmitter's UHF output pulses on and off with the control codes.

To serialise the codes, the encoder chip includes an internal oscillator that uses R1 (1M) as the timing element. Needless to say the corresponding frequency of the decoding chip in the receiver must be set to match this frequency, for correct decoding.

As you can see the LED is also connected to the control code output from the encoder chip, via series resistor R3. As a result the LED pulses during transmission, confirming that a transmission is taking place and also indicating of the state of the battery.

The SM5023RF encoder chip has a total of 12 tri-state coding inputs (pins 1-8 and 10-13), but in this application four of them are used for the pushbutton inputs — i.e., to send the codes for the four control channels. This leaves eight inputs available for the security coding, and each input can be tied to +5V ('1'), tied to 0V ('0'), or left floating. This means that together they can be programmed for 3^8 or 6561 different unique security codes. (As you'd expect, though, the corresponding inputs on the SM5035RF-M4 decoder chip in the receiver must be programmed with exactly the same code, in order to respond to the signals.)

Pin 14 of the SM5023RF encoder chip is its 'transmit enable' pin, and must be pulled low for the chip to transmit the desired code. In this circuit this is achieved by transistor Q2, as you can see. The four channel code buttons (PB1-4) are connected so that when any pushbutton is pressed, it delivers base current to Q2 (via one of the resistors R6-9) as well as applying a logic '1' to its particular coding input of the SM5023RF. So Q2 is turned on to enable IC1 whenever any of the buttons is pressed.

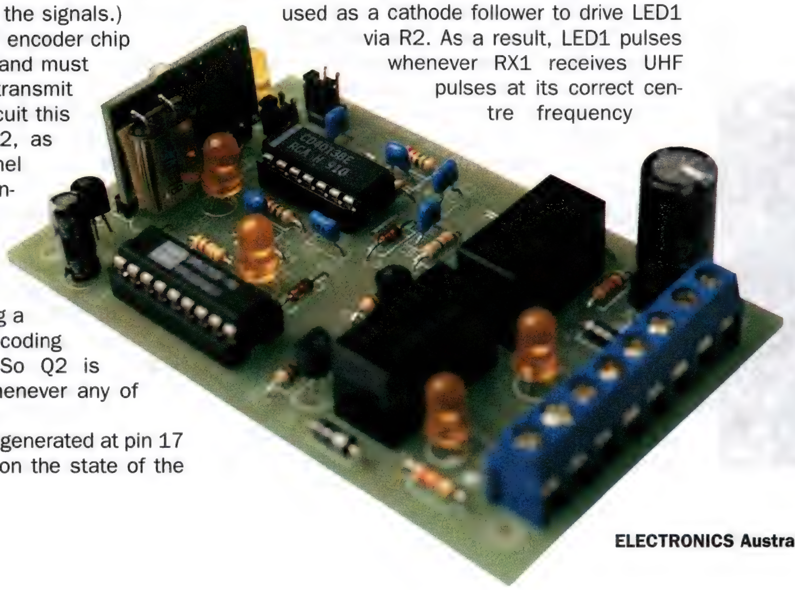
The exact code sequence generated at pin 17 of the SM5023RF depends on the state of the eight hardwired coding inputs, as well as which pushbutton is pressed. As pins 10, 11, 12 or 13 are all coding inputs, and only the one connected to the currently pressed button is pulled high ('1'), this means that a different code is sent in response to pressing each of the four buttons — so distinguishing between the channels.

Receiver operation

Although there's a choice of two different receiver boards, for either two- or four-channel operation, most of their circuitry is identical. The only real difference is that the four-channel board has twice as many output relays and driver stages, and also twice as many flipflops for the toggle-action memory. So in the following explanation of receiver operation we'll concentrate on the two-channel receiver of Fig.2; just remember that the four-channel board has two extra output sections.

To receive the UHF signals from the transmitter, the receiver uses a small pre-assembled and prealigned crystal-locked superhet UHF receiver module (RX1). The received binary code data appears on pin 4 of the module, which as you can see is connected to the data input (pin 14) of the SM5035RF-M4 decoder chip (IC1).

Also connected to the module's received data output is the base of transistor Q1, which is used as a cathode follower to drive LED1 via R2. As a result, LED1 pulses whenever RX1 receives UHF pulses at its correct centre frequency



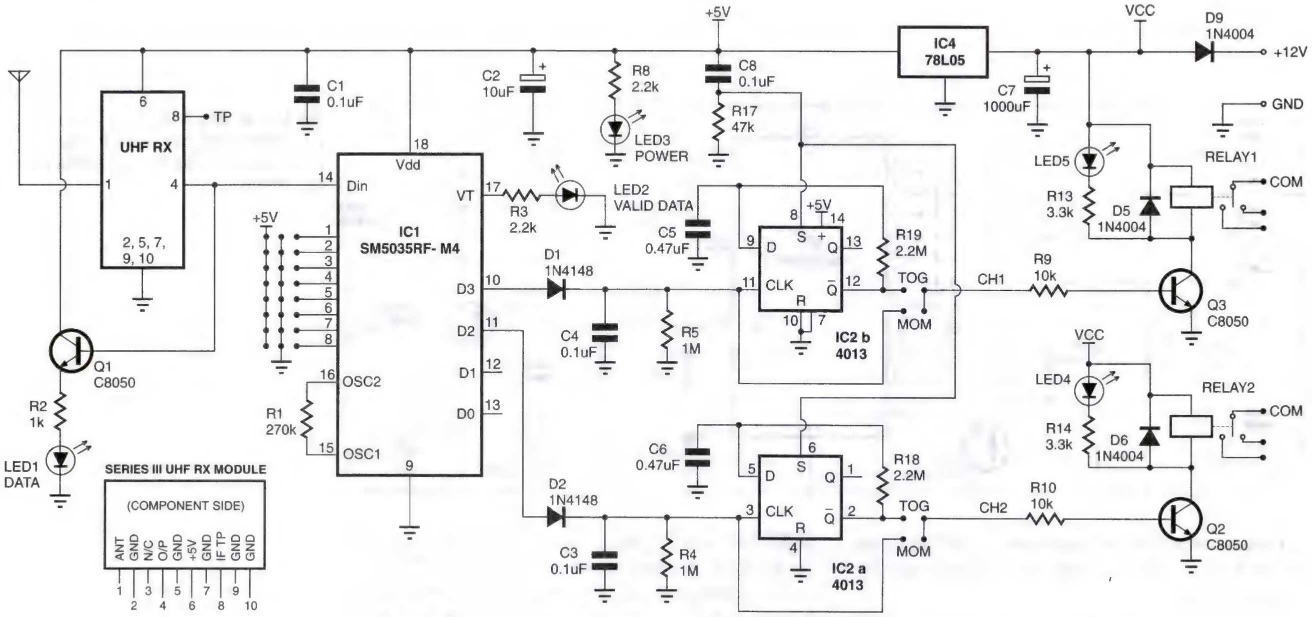
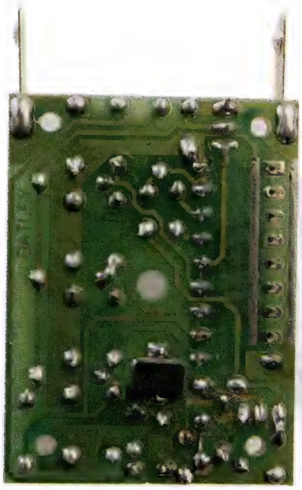


***Fig.2:** A pre-aligned UHF receiver module makes light work of the receiver, with the circuit above switching two channels. The four channel version duplicates the flipflop/driver circuitry on outputs D1 and D2 of IC1.*

***Here's how** to solder in the SAW filter on the rear of the transmitter PCB. With any luck, your soldering will be a lot better than that on the prototype...*



of 433.92MHz, allowing the LED to be used as a 'data received' indicator.

Now the decoder chip is designed specifically to decode the signals from the SM5023RF encoder, and is more or less its 'mirror image'. Like the encoder it has a set of eight tristate security coding data inputs (pins 1-8), and as we saw earlier these have to be programmed with exactly the same pattern of 1's, 0's and 'floating' levels if the decoder is to respond to its codes.

Also like the encoder this chip has an internal timing oscillator, which must again be set to the corresponding frequency. In this case the frequency is set by resistor R1, which needs to have a value of about a quarter that used for the encoder.

When the decoder has been set up with the correct security code and timing frequency to match the transmitter's encoder, it responds to the incoming data from the receiver module by taking its 'valid transmission' or VT output (pin 17) high. It also responds to the 'data' part of the transmitted code by supplying a high (1) at one of its four data outputs (pins 10-13). Which pin goes high depends on the code sent, of course.

In this circuit we use the high on the VT output to drive LED2, via resistor R3, so LED2 indicates whenever *valid* data codes have been received. The actual data outputs from IC1 are used to control the system's outputs, with only two of them used in the two-channel receiver board but all four used in the four-channel board.

Regardless of how many output channels are fitted, though, each of them uses identical circuitry. And you can see how this works if we look at the lower output channel in Fig.2, driven from pin 11 of IC1.

First components D2, C3 and R4 are used to form a fast-attack, slow decay 'pulse linker' — ensuring that the voltage across C3 stays high continuously for the time that a sequence of code pulses are received (i.e., while a transmit button is kept pressed). The resulting continuous pulse is then used in two ways: to clock flipflop IC2a, so that the flipflop 'toggles' back and forth (i.e., changes state) on alternate button presses; and also to feed the relay driver transistor Q2 directly, if you fit the jumper for 'Momentary' operation.

When the jumper selects Mom operation, the pulse is fed directly to the base of Q2 via current limiting resistor R10. As a result Q2 is simply turned on for the duration of the transmitted pulses, energising the relay in its collector circuit and hence controlling load current for that channel. Clearly in this mode the relay will only operate while the pulses are transmitted — hence the description 'momentary'.

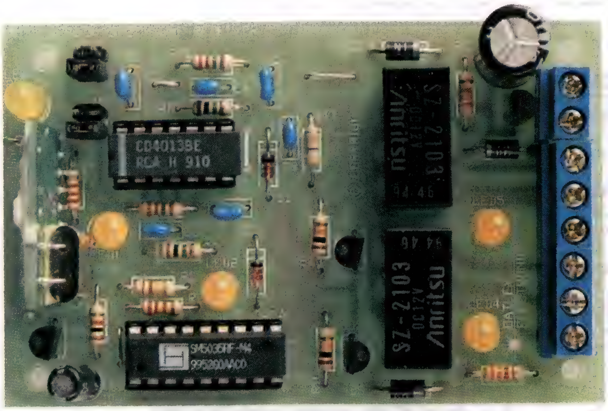
On the other hand when the jumper is fitted for Toggle operation, the incoming pulses are now fed only to the flipflop, while the base of Q2 is now driven from one of the flipflop outputs. So now the relay is only energised when the flipflop is in one of its two stable states. As this occurs following only every *alternate* press of the transmit button for that channel, this results in 'press on/press off' or toggling operation.

Note that components R18 and C6 are used to ensure that the flipflop can only change state about one second after its last change, giving more reliable operation. Diode D6 is connected across the relay coil to protect Q2 from inductive back-EMF 'spikes', while LED4 and its series resistor R14 are to provide visual indication when that channel output is activated.

As you can see, the upper output channel in Fig.2 is identical to the one we've just described, but using IC2b, Q3 and LED5.

As the UHF receiver module requires a 5-7V DC supply, a low current 5V voltage regulator (IC4) is used to supply +5V for the receiver module, the decoder chip and the toggle memory flipflop chips. Capacitor C8 and resistor R17 form a power-on reset circuit for the flipflops, so that any channel that's set for

__The two-channel__ receiver board, with socketed ICs. Make sure you install the pre-tuned UHF receiver module correctly, with the crystal facing inwards.



Toggle operation is automatically off when power is first applied. LED3 indicates the presence of supply voltage, while diode D9 is used to prevent circuit damage if the board is ever accidentally connected to a 12V power source with the wrong polarity.

Transmitter assembly

The transmitter is quite small and as a result calls for a considerable amount of care during assembly. The first step is to install the battery clips on the end of the PCB, and confirm that the PCB then fits neatly into the case. A small mount of filing may be required to ensure this. Note that the board has a 1.5mm hole near each corner, and these holes mate with spigots moulded into the bottom half of the case. A 3mm hole in the centre passes the screw that holds the two halves of the case together, when the transmitter is complete.

Once you're satisfied that the PCB and battery are going to fit in the case neatly, you can fit the components using the PCB overlay diagram and internal photo as a guide. All of the components must be mounted as close to the PCB as possible, with the exception of the LED. This must be mounted with its body up 5mm from the board, so that it fits into the hole on the top of the case.

Do not use an IC socket for the encoder chip, as there is not enough room inside the case; just make sure you fit the chip in the correct way around.

Note that the SAW resonator (X1) must be mounted on the copper side of the PCB. Only two of the four pads on the SAW need to be soldered — the two in the centre of the longer sides. Be careful not to overheat this component with the soldering iron; it's easily damaged.

There's no separate piece of wire supplied in the Oatley kit specifically for inductor L1. However as this only needs two turns, spaced about 1mm apart and with a diameter of 3-4mm, you should be able to use one of the leads cut from the resistors after it has been soldered in.

Be careful when you're bending the resistor leads, because the resistor bodies are very small and the leads must be bent quite close to them. Ideally use a tiny pair of needle-nose pliers to prevent strain.

Oh — a final but very important point about transmitter assembly: **Do NOT fit the security coding data links to pins 1-8 of the SM5023RF encoder chip at this stage. Leave all eight pins 'floating' until you've made sure that the transmitter and receiver are working together properly.**

Receiver assembly

Construction of either receiver board is relatively easy, as most of the work has already been done in the pre-assembled UHF receiver module. This 10 pin module is polarised and must be placed according to the outline shown on the PCBs and

PARTS LIST

Transmitter

resistors	
All 1/8W 2%:	
R1	1M
R2,6-9	10k
R3,4	3.3k
R5	47 ohms
capacitors	
C1	10nF disc ceramic
C2	2.2pF NPO disc ceramic
C3	7pF NPO disc ceramic
C4	1nF disc ceramic
C5	4pF NPO disc ceramic
semiconductors	
IC1	SM5023RF encoder
Q1	2SC3355 UHF NPN silicon
Q2	BC548 NPN silicon
LED	3mm red LED
miscellaneous	
X1	433.92MHz SAW resonator

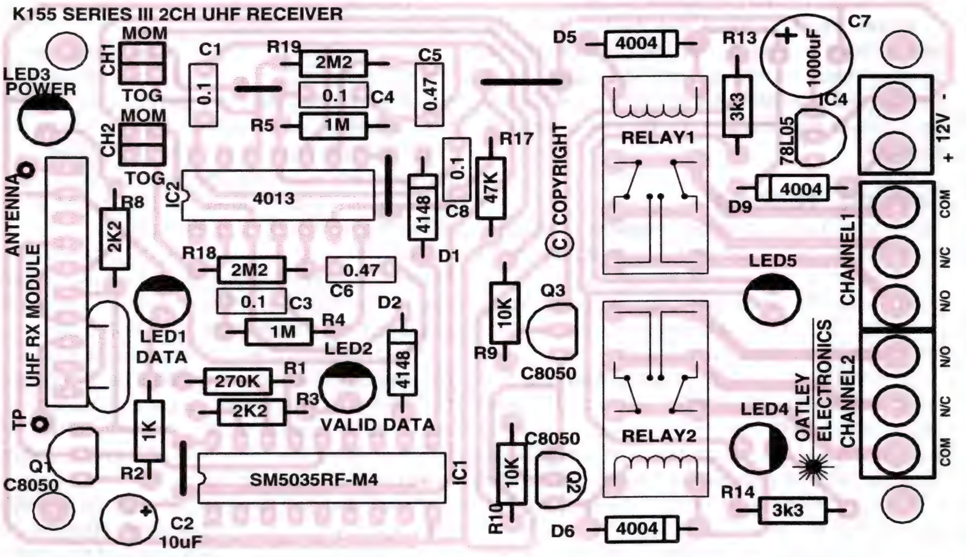
PCB, 41 x 31mm, K154 (Oatley copyright); matching keyfob-type plastic case, 63 x 35 x 14mm; 4 x miniature pushbutton switches; 2 x battery connection clips; miniature 12V battery, type 23A.

4-Channel Receiver

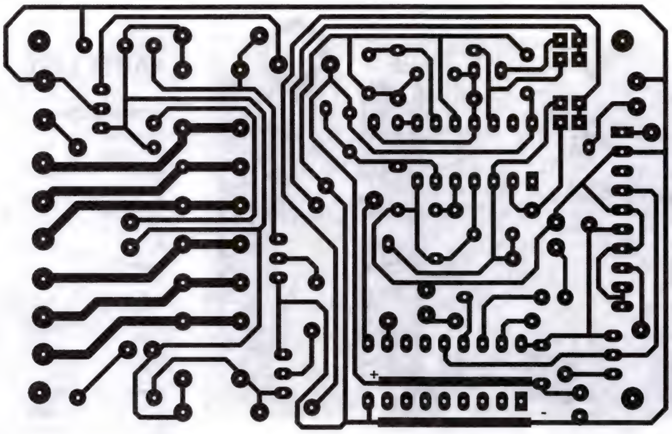
Resistors	
All 0.25W 2%:	
R1	270k
R2	1k
R3,8,13, R14-16	2.2k
R4-7	1M
R9-12	10k
R17	47k
R18-21	2.2M
Capacitors	
C1,3-6,8	0.1uF monolithic
C2	10uF 10VW RB electrolytic
C7	1000uF 16VW RB electrolytic
C9-12	0.47uF monolithic
Semiconductors	
IC1	SM5035RF-M4 decoder
IC2,3	4013 dual D-type flipflop
IC4	78L05 low power 5V regulator
Q1-55	C8050 gp NPN silicon
LED1-7	5mm orange LED
D1-4	1N4148 signal diode
D5-9	1N4004 1A power diode
Miscellaneous	
RX1	UHF receiver module SRX
Relay 1-4	12V PCB-mount relay, SZ-2103

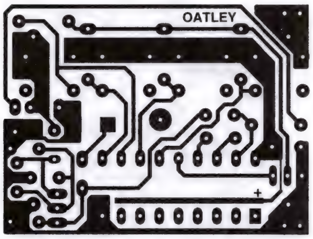
PCB, 125 x 76mm, code K156 (Oatley copyright); 4 x 3-way PCB mount terminal blocks; 1 x 2-way PCB mount terminal block; 4 x 2x2 PCB header pin blocks; 4 x jumper shunts; 2 x 14-pin DIL sockets; 1 x 18-pin DIL socket; 1 x 190mm length of insulated hookup wire for UHF antenna; solder, etc.

NOTE: Complete kits for this project are available from Oatley Electronics — see separate box.



__The overlay__ for the two-channel receiver board. Space didn't permit the overlay for the four-channel version, but with the professional silk-screened board overlays, you shouldn't have too much trouble constructing it.





***We know** that some of you out there still make your own boards, so here is the artwork for both the transmitter and two-channel receiver PCBs.*

overlay diagrams. The side of the PCB covered with a white plastic 'conformal coating' goes toward the edge of the main board with the 'crystal' side innermost, in both cases.

Once the receiver module is fitted, you can fit the rest of the components, starting with the smaller low-profile parts and working your way up to the larger parts. Note that decoder timing resistor R1 must be 270k, not 1M as shown on some early Oatley PCBs. Take care to fit all LEDs, transistors and diodes the correct way around, using the PCB overlays and silk screening as a guide.

Three short wire links must be placed on the two-channel board, at the locations where a white line is screened on the top of the board between two holes. These positions are also indicated on the PCB overlay. The links are easily made using resistor lead offcuts. There are no links needed on the four-channel board.

Each board uses 2x2 header pins for the Mom/Toggle links, so that SIL jumper shunts can be placed on the headers for each channel to program them for momentary or toggling operation as desired.

For the antenna needed on the receiver boards, simply use an insulated piece of hookup wire about 190mm long (1/4 wavelength at 433MHz).

Again, don't connect the custom security coding links to pins 1-8 of the SM5035RF-M4 decoder chip on either receiver board, until you've tried the finished transmitter and receiver together and made sure they're operating correctly.

Testing, testing

When your transmitter and receiver are both assembled, you should be ready to power them up and try them out. First though, check each board carefully for solder bridges, bad solder joints and so on. Fix any problems you find at this stage, to prevent trouble later.

Now fit the transmitter PCB carefully into the lower half of the transmitter case, and fit the small 12V battery between its clips — making sure of the polarity, of course. The red (+) end goes to the side nearest the pushbuttons. The LED may blink briefly as the battery is fitted, but should then go out.

Try pressing any of the buttons: the LED should light while to hold any button down, but stop when you release the button. If this seems to happen, your transmitter is probably working correctly.

Now connect the receiver board to a suitable 12V DC power source, and check that LED3 glows to indicate that power is present. Then when you press any of the buttons on the transmitter, LED1 should glow to indicate that the receiver module is responding to pulses from the transmitter. If it doesn't, or only when the transmitter is very close to the receiver's antenna, you may need to adjust coil L1 on the transmitter. Try squeezing the turns a little closer together, or alternatively nudging them a little further apart, until LED1 on the receiver glows reliably each time a button is pressed (with the transmitter and receiver a few metres apart).

You should also have noticed that LED2 on the receiver also glows each time a transmitter button is pressed. If it doesn't, your decoder isn't properly recognising the encoder's pulses. You may have accidentally linked a coding pin of one or the other to +5V or ground accidentally, via solder bridge; or else you've fitted a wrong value resistor for one of the timing resistors (R1). Check these possibilities if necessary, until LED2 operates in tandem with LED1.

Finally, check that either two or four of the output channel LEDs (depending on which receiver board you're using) operate in response to the appropriate transmitter buttons, and in either toggling or momentary mode depending on the positions of the jumper for that channel. If this all happens, your remote control system is probably working correctly.

Security coding

NOW, and ONLY now, after everything has been checked out in terms of basic operation, is the time to fit the security coding links to pins 1-8 of the encoder chip in your transmitter, and the decoder in your receiver.

As mentioned earlier these data coding inputs are tri-state. I.e., each data pin may be either left floating, tied to +5V or tied to 0V. Both the transmitter and receiver boards have copper strips running past these IC pins on either side, to make this easy; all you need to do is either leave a pin unconnected, or link it across to either the +5V or 0V line as you wish.

Just make sure the power is disconnected before you connect these links, to prevent damage to the chips; and also solder very carefully to prevent overheating the IC or PCB tracks.

Most important of all, make sure that you use **exactly** the same combination of connections on your transmitter encoder and receiver decoder. Otherwise, they'll suddenly refuse to talk to each other — and your remote control system won't work anymore.

Match the two correctly, though, and they'll work exactly as before. The only difference is that now your receiver **won't** respond to a transmitter set for any of the **other** 6560 possible code combinations. ■

KITS AVAILABLE

Complete kits for the Series III UHF Remote Control System are available from the designers, Oatley Electronics, at very reasonable prices:

- K154 Transmitter, including case $18
- K155 2-Channel Receiver Board (includes K154) $45
- K156 4-Channel Receiver Board (includes K154) $60

If ordering by mail or email for posted delivery, add $6 for packing and postage. Orders are directed to Oatley Electronics, PO Box 89, Oatley NSW 2223, or **sales@oatleyelectronics.com**. For more information visit the Oatley website (**www.oatleyelectronics.com**).

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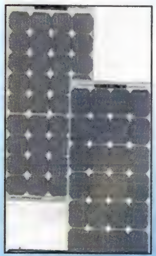

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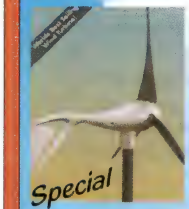

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Complex or **KISS?**

We've got a funny collection of stories this month. It covers test equipment, TVs AND fairy stories!

I'LL START OFF this month with a short item from my own workshop.

Back in January 1997 (That was back in the last century, in case you had forgotten!) I wrote about fixing a problem in my 'New' oscilloscope. Now we return to the same subject, and as it turns out, to the same problem!

On that last occasion a contact had broken off inside a plug leading to the tube base. It was one lead to the tube heater and this had killed the trace. I replaced the broken contact with one taken from an old Beta VCR and everything came good. And everything has remained good for nearly three years.

Then just after Christmas I decided to check out some distortion that had crept into a stereo amplifier that I use for entertainment in the workshop. I wanted to use the CRO to examine waveforms but when I switched on the instrument, it responded with lots of deadness. The front panel LEDs lit up OK, but the screen showed no sign of a trace.

If you remember the last story, I mentioned that the CRO had come with a very comprehensive manual. I hate to think about how I might have solved the problem if that manual and it's wealth of detail had not been available.

A check of voltages from the power supply showed them all to be some 10% low but adjusting them to the right value made no difference. The only voltage I could not check was the heater supply — a 6V high-frequency supply derived from a winding on the EHT chopper transformer. When the heater supply failed last time, I was unable to read any voltage with the multimeters then in my possession.

At that time I used another CRO to check for heater voltage. I have since sold off that old instrument so for a time it looked as though I might be in trouble with the present fault. However, I have since bought a new analogue multimeter with a good response to high frequency AC. (I still prefer analogue meters to the digital variety. They may not be as accurate but they are usually faster and give more easily understandable readings.)

This meter showed that I had heater voltage right up to the plug that caused the last problem, but no further. It seemed as though I was having a replay of the last act. Unfortunately, I had junked the old Beta VCR that had supplied the replacement contacts last time. Isn't it always the way? You dump your junk and next day you desperately need what you have just discarded!

Anyway, I carefully examined the plug pins and the socket but could see no problems. I couldn't get a meaningful resistance reading because of alternative circuit paths. But it did look as though I had another open circuit plug and socket. After fiddling with the contacts for several minutes, I decided to give the whole system a bypass. A short length of figure-8 speaker cable was soldered between the copper side of the plug pins on the circuit board and the heater pins on the tube socket.

At switch on, I had a nice bright trace and all the other functions were working as they should.

When my workshop was going full blast, I never had time to fiddle with my tools. If I couldn't buy a new one, for whatever reason, I put it aside until I could find time to solve the problem. However, since my retirement I have learned a lot about the insides of most of the various instruments in the shop. It has been quite a revelation.

Overly complex

Now we come to another story from a "Gentleman in retirement". It's from Doug Thwaites, of Esk in Queensland. Doug has contributed several stories in the past and, as you'll see, he is puzzled by the complexity of some modern circuitry. Here's what he has to say....

I am 82 years old and still servicing. The reason? When I finally retired at 75 we moved from the suburbs of Brisbane to a small country town where the smallest block is half an acre, there's no crime, no pollution and no noisy neighbours.

But unlike the city, here everyone knows everyone else's business, and after I had done a favour for my neighbour and fixed his TV, that was it. Everyone in town was soon beating a path to my door. I don't mind really as it's only a small town and I'm not rushed off my feet.

THEN THE KING ASKED, "HOW WOUL

During the 60 years I have been in the service business, the one thing that strikes me most is the way everything has become so complicated. When I think back to the 60s I can remember going out with a small suitcase full of valves and doing at least 10 service calls a day. 99% of the problems were faulty valves.

Some of the Television receivers I meet today seem to be deliberately made more involved than they need be. Take the case of a Sharp I have just fixed. It's a model 3434 and has the usual switchmode power supply. It had no sound or picture and there appeared to be no activity at all. But when I got the CRO on it, I found that the power supply came on and worked for about one second.

When I got out the manual and studied the circuit, I found what to me seems an unnecessarily *involved system. First the mains voltage is rectified to provide DC for the switching circuit. A 'startup' circuit kicks the switching circuit into action. This produces two DC voltages in its output, 115V and 12V. The 115V is used to power the horizontal output stage. This voltage is reduced to 12V on the horizontal oscillator chip from where it feeds the horizontal drive circuit and the horizontal output circuit.*

Then an insulated winding on the horizontal output transformer feeds a signal back to the power supply to keep it running. If this does not happen by the end of that second after switching on, the set just sits there doing nothing. Once the line output transformer is operating, it produces DC voltages to work the receiver itself.

To get back to servicing it, I had one second to look for faults every time I switched it on. I found four very dry joints, in fact very little solder on two of them. I often find where solder seems to have migrated away from the joint. Is it electrolysis?

By using a 50Hz transformer like the old days, a lot of this involved circuitry could have been eliminated. I still cannot see the advantage of a convoluted circuit like this.

Thanks for that little story Doug. There's no doubt that you've seen a few changes in electronics design since you began in the industry. And I tend to agree with you that not all the changes have been for the better. However, the change that troubles you in the story above is one of those that really were for the better. Modern power supplies have benefits and efficiencies that far outweigh their complexities.

I remember when I saw my first Kriesler 59-01 colour TV. I couldn't credit the complexity of the power supply. During a slack moment, I compared the parts count in an earlier Kriesler B/W set with the count in the colour set. The monochrome set had a power supply consisting of three components - a transformer, a double diode rectifier, and an electrolytic capacitor. The colour set had well over 100 parts in the supply. I lost count around the 100 mark!

It was a couple of years before I learned what the Kriesler designers had been up to when they worked out the 59-01 supply. I was called to service a late model black and white set in a remote country location. The set only played up in the late afternoon and early evening. The trouble was caused by low mains voltage - the mains dropped to 180V when everyone was cooking dinner.

The AC input switch was already set to the lowest voltage, 220V, but this was not enough. In the end, I told the customer that I would try to find a suitable step-up transformer that they could switch in whenever the mains voltage dropped too low.

U DESIGN AN EMBEDDED COMPUTER TO CONTROL IT?"

However, while I was hunting about for this transformer, the customer rang to say that they had decided to go for colour and asked if I would collect, deliver and install the set for them. They had bought a new Kriesler and we found that it worked perfectly on their 180V mains, without any adjustments at all. It was also perfect during the day when the mains went up to 220V. And similarly in the early morning, when the mains reached the rated 240V.

So that was one benefit of the regulated switchmode power supply, compared to the conventional unregulated supply fitted to earlier sets. Other benefits are light weight and simpler filtering due to the high operating frequency. As time has passed, we've found that switchmode supplies are fairly reliable. They have a few characteristic faults that are easy to recognise after you've seen them a few times. So all in all, the complications have been worthwhile.

However, there are a lot of other 'modern' developments that do not have the same benefits.

The following story arrived by email from a person or persons unknown. It was actually directed to the editor of a TETIA newsletter but I thought it was too good to commit to only a small audience. So I grabbed a copy. If you have ever struggled over the complicated functions and user interface of some new device, the following 'Modern Fairy Tale' will amuse you no end.

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A Fairy tale

Once upon a time, in a kingdom not far from here, the King summoned two of his advisors for a test. He showed them both a shiny metal box with two slots in the top, a control knob, and a lever. "What do you think this is?" he asked.

One advisor, an engineer, answered first. "Its a toaster," he said. Then the King asked, "How would you design an embedded computer to control it?"

The engineer replied, "Using a four-bit microcontroller, I would write a simple program that reads the darkness knob and quantises its position to one of 16 shades of darkness, from snow white to coal black. The program would use that darkness level as the index to a 16-element table of initial timer values.

Then it would turn on the heating elements and start the timer with the initial value selected from the table. At the end of the time delay, it would turn off the heat and pop up the toast. Come back next week and I'll show you a working prototype."

The second advisor, a computer engineer, immediately recognized the danger of such short-sighted thinking. He said, "Toasters don't just turn bread into toast, they are also used to warm frozen waffles. What you see before you is really a breakfast food cooker. As the subjects of your kingdom become more sophisticated, they will demand more capabilities. They will need a breakfast food cooker that can also cook sausage, fry bacon, and make scrambled eggs. A toaster that only makes toast will soon be obsolete. If we don't look to the future, we will have to completely redesign the toaster in few years.

With this in mind, we can formulate a more intelligent solution to the problem. First, create a class of breakfast foods. Specialize this class into subclasses: grains, pork, and poultry. The specialization process should be repeated with grains divided into toast, muffins, pancakes, and waffles; pork divided into sausage, links and bacon; poultry divided into scrambled eggs, hard-boiled eggs, poached eggs, fried eggs, and various omelet classes.

The ham and cheese omelet class is worth special attention because it must inherit characteristics from the pork, dairy and poultry classes. Thus, we see that the problem cannot be properly solved without multiple inheritance.

At run time, the program must create the proper object and send a message to the object that says 'Cook yourself'. The semantics of this message depend, of course, on the kind of object, so they have a different meaning to a piece of toast than to scrambled eggs.

Reviewing the process so far, we see that the analysis phase has revealed that the primary requirement is to cook any kind of breakfast food. In the design phase, we have discovered some derived requirements. Specifically, we need an object-oriented language with multiple inheritance. Of course, users don't want the eggs to get cold while the bacon is frying, so concurrent processing is required, too.

We must not forget the user interface. The lever that lowers the food lacks versatility, and the darkness knob is confusing. Users won't buy the product unless it has a user-friendly, graphical interface. When the breakfast cooker is plugged in, users should see a cowboy boot on the screen. Users click on it and get the message 'Booting Breakfast Food Cooker'. Users can pull down a menu and click on the foods they want to cook.

Having made the wise decision of specifying the software first in the design phase, all that remains is to pick an adequate hardware platform for the implementation phase. An Intel Pentium II with 64 MB of memory, a 8.4GB hard disk, and a 19" SVGA monitor should be sufficient. If you select a multitasking, object oriented language that supports multiple inheritance and has a built-in GUI, writing the program will be a snap. Imagine the difficulty we would have had if we had foolishly allowed a hardware-first design strategy to lock us into a four-bit microcontroller!"

The King had the computer engineer thrown in the moat and he and the rest of his kingdom lived happily ever after.

Now! Doesn't that ring a bell? It sounds very much like some VCRs I've come across. I wonder if designers ever consult with the potential users of their products. Next time you are trying to understand how the designers got two buttons to execute twenty seven functions, remember what the King did to his adviser.

It seems that computer engineers have never heard of the "KISS Principle". Keep It Simple, Stupid! is the best advice ever given to anyone designing anything! Unfortunately, no author was cited with that story so we can't give him/her proper acknowledgement. That's all for this month. I have a number of unusual items in the files now so watch for something different next time. ■

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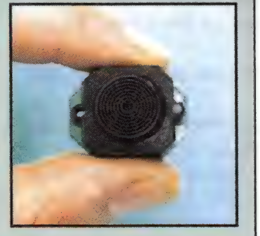

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Simple security

How do you get one small security device to monitor an area of up to 500 square metres without using wires, infrared detectors, proximity sensors, lifeform tricorders or other fandangled gadgetry? By sensing changes in air pressure, that's how...

By Rob Evans

DUBBED A 'VOLUMETRIC' ALARM, the Air Block Security Alarm 2000 is a clever little system that simply monitors the air pressure in a room or building, then sets off an audible alarm in response to a short-term pressure change — such as that generated when a door opens.

It's a fiendishly simple concept, and means that the system is able to monitor small rooms right through to a whole house, just by picking up fluctuations in the internal air pressure. The size of the pressure change created by an opening door will vary with room volume (less for a larger space), but the Air Block compensates for this with a sensitivity control that's calibrated in room volume. With the one unit then, all entry points in the premises are automatically monitored though this simple principle — the doors and windows need to be closed though, as you might imagine.

The Air Block is battery powered (6 x AA Alkaline), measures just 225 x 150 x 35mm and weighs in at around 0.8kg, so it's very much a portable security alert system that can be plonked down wherever it's needed. It has three alarm sounding modes that are selected via a pushbutton switch, a keylock arm/disarm switch, and two small slide switches to set its trigger sensitivity to match the room volume in six ranges. That's all there is to it; no wiring or sensors to install, power supplies to connect, or security keypads to fiddle with.

Depending on which sounder mode is selected, the Air Block can be used as a door minder for a shop or office, or as a boots-and-all security device. In door minder mode the built-in peizo sounder emits a relatively sedate two-tone chime when the unit is triggered, while the siren mode lets the peizo go at it's full 120dB screeching fury to scare the wobblies out of anyone nearby. Fortunately there's a delayed siren mode as well, which gives you a 20 second entry/exit period for dealing with the nasty little critter.

Great idea, but does it work?

In a word, yes. We set up the Air Block in a variety of rooms and spaces and found that the unit lived up to it's promises, in both its chime and siren modes. You really need to play about with the sensitivity setting to make sure the unit will trigger on a gentle door opening without false triggering, but this is the only adjustment needed.

We donned our balaclavas and took up the challenge of sneaking into the room by opening the door very slowly, but the Air Block managed to catch us in the act almost every time. It's success does depend on the type of building to a degree though, since older buildings are generally not as well sealed, which tends to damp out the pressure fluctuations.

The main attraction of the Air Block's is that it's small, portable and very easy to setup. This makes it just the shot for apartments, shops, when you're travelling, or for homes where a traditional security installation system isn't practical. Unlike other intruder sensor systems you can move about the room in a normal way with the alarm still on, and only problem then is that you might forget about it and try to open a door...

If you need a clever shop door minder, a personal alarm system, or you just want to find out who in your household has been raiding the fridge at night, the Air Block is well worth a look. It's cheaper than a Rottweiler and makes far less mess on the carpet, is priced at $198, and you can find it at Dick Smith Electronics Stores around Australia; phone 1300 366 644 or visit their website at **www.dse.com.au.**■

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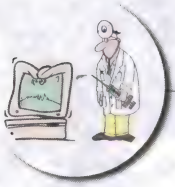


COMPUTER **CLINIC**

BY JEAN BAPTISTE CATTLEY

Missing drives, saving your CMOS, and some excellent tweaking software...

Drive away

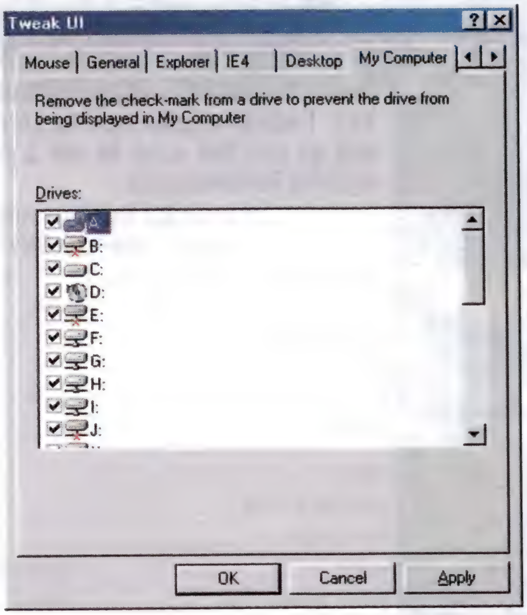
I HAVE installed a new 10GB hard drive partitioned into five 2GB logical drives. These are all accessible but are not recognised by Win98 in either My Computer or Explorer.

The same applies to my CD drive. All the hard drives are manufactured by Seagate, and I used the Seagate wizard software to handle the installation, partitioning, copying and updating of the CD-ROM files. The physical drives are all reported by the BIOS and shown in the correct channels. Processor is an 233MMX Pentium with 128MB of memory. Is the problem fixable? (Noel Lipscombe, by email)

■ Hmmm... I must admit I've not seen drives spontaneously disappear before, however there's a couple of ways you could have accidentally hidden them. The first way is by using the My Computer tab in TweakUI; if you've unchecked the boxes here, your drives won't show up. If you don't have TweakUI installed, you should. It's in the \tools\reskit\powertoy directory on your Windows CD, and has more Windows tweaking goodies than you can shake a stick at. Install it by right-clicking TWEAKUI.INF, and hitting 'Install'.

Another thing that may have happened is that someone may have been fiddling with Poledit, the System Policy editor. This is another interesting tool, however unlike TweakUI, which brings you dozens of micro-features, Poledit's main purpose is to disable features — to prevent unauthorised users from changing settings, running certain programs, or rooting through your data. One of the restrictions it offers is (you guessed it) to hide drives in Explorer. To re-enable the drives, open Poledit, go to File | Open Registry, then double-click Local Computer, and navigate down to Windows 98 System\Shell\ Restrictions, and disable 'Hide drives in My Computer'. Poledit isn't just for the paranoid security-freaks among you, it can set useful defaults, take away confusing and unneeded options, and protect your system from idiots. If you want to install it, follow the instructions in \tools\reskit\netadmin\poledit\ readme.txt on your Win98 CD. You want to be a little careful when playing with Poledit, as some of the security options can actually prevent you from running the program — keep a backup of your registry before you play with it.

One nice little trick I've come across for the NT users out there: if you use the command line a lot, you're doubtless sick of continually typing those oh-so-convenient long filenames — typing 'December 1999 Monthly Financial Reports Summary.xls' gets kinda wearing the fifth time you have to do it. Luckily, there's a better way. Run Regedit, go to HKEY_CURRENT_USER / Software / Microsoft / Command Processor, and look for a key called CompletionChar. If it isn't there, add a key with that name of type DWORD. Once you have a CompletionChar key, edit it, and set its value to 9. Now if you type the first few letters of a filename and hit Tab, the system will complete the filename for you. If the characters you typed aren't enough to uniquely identify the file, pressing Tab will display the first matching filename; pressing it again will cycle through the remaining matches.

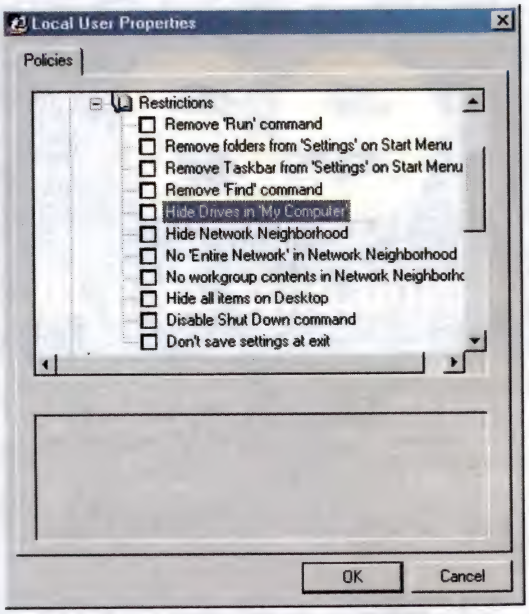


Remove the check-mark from a drive to prevent the drive from being displayed in My Computer

Drives:

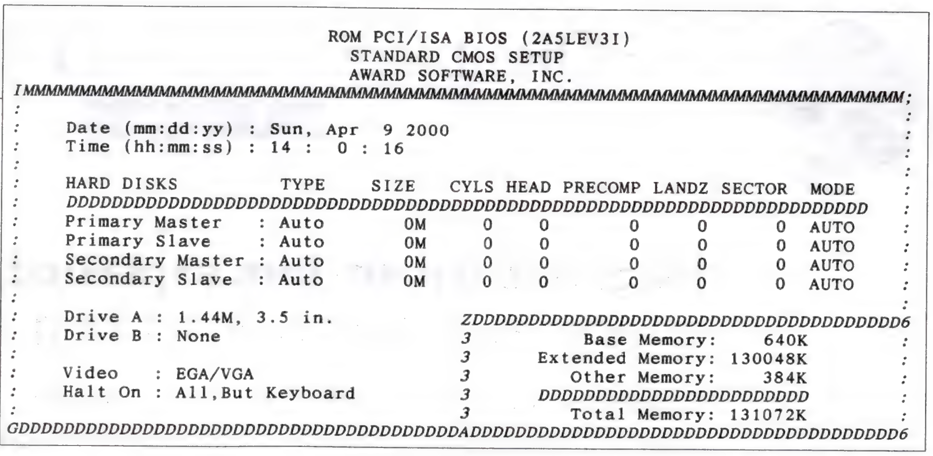
☑ A:
☑ B:
☑ C:
☑ D:
☑ E:
☑ F:
☑ G:
☑ H:
☑ I:
☑ J:

TweakUI *can hide unwanted drives, and is useful for getting rid of things like the phantom B drive you can get after installing an internal Zip drive.*



Restrictions
☐ Remove 'Run' command
☐ Remove folders from 'Settings' on Start Menu
☐ Remove Taskbar from 'Settings' on Start Menu
☐ Remove 'Find' command
☐ Hide Drives in 'My Computer'
☐ Hide Network Neighborhood
☐ No 'Entire Network' in Network Neighborhood
☐ No workgroup contents in Network Neighborhc
☐ Hide all items on Desktop
☐ Disable Shut Down command
☐ Don't save settings at exit

Right: *A more heavy-handed aproach is to turn off all dives with the Policy Editor...*



```
                         ROM PCI/ISA BIOS (2A5LEV3I)
                           STANDARD CMOS SETUP
                           AWARD SOFTWARE, INC.
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM;
:                                                                           :
:    Date (mm:dd:yy) : Sun, Apr  9 2000                                     :
:    Time (hh:mm:ss) : 14 :  0 : 16                                         :
:                                                                           :
:    HARD DISKS         TYPE    SIZE   CYLS HEAD PRECOMP LANDZ SECTOR  MODE :
:    DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD   :
:    Primary Master   : Auto      0M     0    0       0     0      0  AUTO  :
:    Primary Slave    : Auto      0M     0    0       0     0      0  AUTO  :
:    Secondary Master : Auto      0M     0    0       0     0      0  AUTO  :
:    Secondary Slave  : Auto      0M     0    0       0     0      0  AUTO  :
:                                                                           :
:    Drive A : 1.44M, 3.5 in.             ZDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
:    Drive B : None                       3        Base Memory:     640K    :
:                                         3    Extended Memory: 130048K     :
:    Video   : EGA/VGA                    3       Other Memory:     384K    :
:    Halt On : All,But Keyboard           3   DDDDDDDDDDDDDDDDDDDDDDDD      :
:                                         3       Total Memory: 131072K     :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDADDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
```

It may not be pretty, *but a quick Printscreen in your CMOS Setup can save you pages of writing it out by hand.*

See your CMOS

I HAVE an enquiry regarding replacement of the motherboard CMOS battery. Well, to be honest, a little more than that. My Compaq Deskpro 2000 running Windows 95 is a little old now, but it does the things I want it to. (So why upgrade?) However I have heard of two problems which can be attributed to the battery (age) other then PCB damage, hence my enquiries. I want to eliminate the battery on the motherboard, and replace it with a set of three long life AA batteries on the rear of the case.

A Circuit and Design Ideas suggested this upgrade (using 100Ω in series to limit the current), a particularly good idea as replacement button cells are expensive. DSE stock a nice three-AA battery case with a neat clip-on cover and switch. (I'll eliminate this switch and replace with the 100Ω resistor I think.) To save a stupid mistake I'll ask a couple of questions if you don't mind.

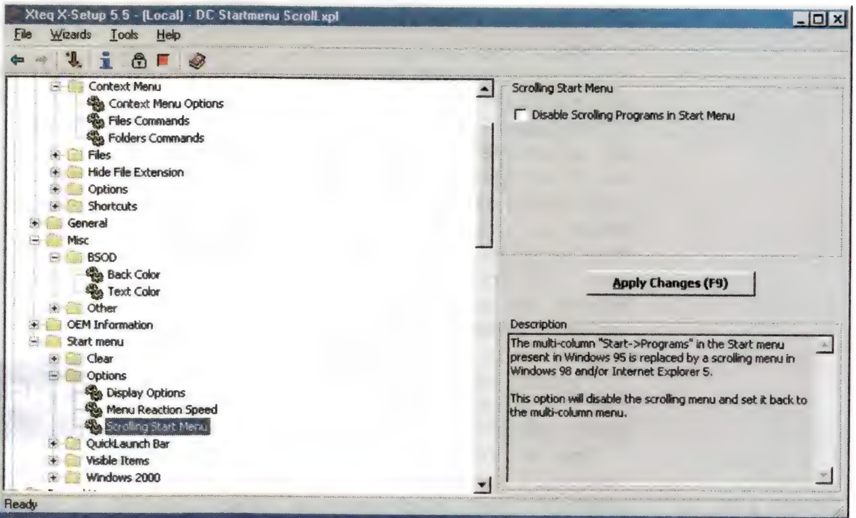
I see no problem with the 'mechanics' of wiring et al, but I know taking the battery out will upset my computer. I'll lose the BIOS setup if I pull out the battery, and I'll need to tell the box who it is, but if I lose the info I no longer have it... oh gawd. I almost wish I'd never got into this mess. Thinking about the above, I had the bright idea of wiring up the replacement case with the original 4.5V button cell in place, fit the three long life cells to the rear mounted case and promptly remove the button cell from the clip — all that can happen is that the new long life cells will briefly try to charge the button cell (at a maximum of 45mA) — at least I think that's all that can happen.

Either way I could end up switching on the PC and looking at a blank screen or being asked some question or rather prompt that I don't remotely understand. I don't have the original motherboard instruction sheet, but I think the hard drive has been replaced — in fact the computer thinks it has two drives (D and E) — that may or may not be important. I should print this 'list' even if I don't have the original instructions just to try and outwit Murphy, if that's possible. JB what would you suggest? It ain't broke, but the battery will go flat. (J. Gibson, Hawks nest NSW)

■ Ok... you can put the two batteries in parallel for a second if you must, though it's not something I'd recommend to anyone else. Far better to simply take down the information, and restore the settings afterwards. Different BIOSes have different setup utilities, so I can't give you exact details. Hit DEL to enter the BIOS setup (or F2 on some computers, check the screen during the memory check)

The critical info is pretty much always kept in Standard CMOS Setup. Here you'll see the settings for your floppy and hard drives, which you'll need in order to boot if the CMOS power is interrupted. That's all that'll really matter; if you have an internal modem, you might want to check which on-board COM ports are enabled, look for this in Integrated Peripherals or Bios Features.

Just a couple of things before you whip out your notebook and start scribbling madly: First, if you have an entry in the main menu that says 'IDE Hard Disk Detection' (or words to that effect), then you don't have to worry about getting the settings for your hard drive, as this menu will fill the values in for you. Secondly, there's a much easier way than writing it all out by hand — just tap the PrintScreeen key on your keyboard (sometimes labelled PrtScr), and it will dump the screen out to the printer. When you're ready to go again, you'll have all the cheat-sheets there and waiting. ■



Scrolling Start Menu

☐ Disable Scrolling Programs in Start Menu

Description

The multi-column "Start->Programs" in the Start menu present in Windows 95 is replaced by a scrolling menu in Windows 98 and/or Internet Explorer 5.

This option will disable the scrolling menu and set it back to the multi-column menu.

With X-Setup, *you can control the world! Mwah ha ha ha ha... Oh, well, bits of Win95, anyway.*

Excellent X-Setup

SOFTWARE PICK OF THE MONTH is X-Setup, from Xteq systems. This handy little app is the mother of all tweaking utilities, leaving Microsoft's TweakUI out in the cold. The current version of X-setup comes with over two hundred tweaks, allowing you to do everything from logging in automatically, to (I kid you not) changing the colour of the Blue Screen of Death.

The best feature of all, though, is the fact that unlike other configuration utilities, X-Setup is extensible: all of the separate tweaks are provided through plugins, so when a new tweak comes out, you can just download a few k of plugin file, and it's instantly available to use.

There's even the X-Setup SDK (Software Development Kit) available, so you can write your own modules! I'd definitely have to say that this is the best configuration util I've ever seen. Go and get it now from **http://www.xteq.com**.

Oh and I shouldn't have to tell you that it's free, now should I?

INFORMATION CENTRE

BY PETER PHILLIPS

Magnetic flowmeters explained, computer monitor surveillance, Smart Ring and other matters

Quite a few topics this month. The prospect of someone monitoring your computer activities by way of the RF radiation from the system, automatically disabling Call Waiting while you're on line are just two, and there's plenty more...

ONE OF THE THINGS I enjoy about writing this column is the variety of topics readers ask about. And you just never know which topic will generate a lot of letters, as many have done over the years. Perhaps the most popular topic recently has been measuring water flow using magnetics, following a reader's request (Bruce Burdekin) for information about this. I included a number of reader letters on this subject last month, but more have arrived since then, including one with manufacturer's information. So, how is water flow measured magnetically in the real world? Here's a brief rundown:

Commercial magnetic flowmeters

This information was sent by Peter Stuart (Carlingford, NSW), and covers three flowmeters: Rosemount 8732C, Promag 30 and the Sparling Tigermag FM625 and FM655. Two of the manufacturers start by referring to Faraday's law of magnetic induction, and give the equation $E = B \times L \times V$, where E = induced voltage, B = magnetic flux density, L = distance between electrodes (also the pipe diameter) and V = average velocity of the liquid. Naturally, the liquid must be conductive, but according to an email from Mick Yemm (Water Information Officer, Dept of Primary Industry, Water and Environment), the Faraday technique is used a lot to measure the flow rate of rivers. I guess our river waters are reasonable conductors from the pollution we seem to generate.

The diagram in Fig.1 relates to the above equation and is from the Sparling document, which goes on to say: "In a magnetic flowmeter the liquid acts as a moving conductor as it flows through the pipe. The induced voltage (E) is measured by two sensing electrodes mounted opposite each other in the meter sensing head. The length of the conductor is the distance between the sensing electrodes which is also the internal diameter (D) of the pipe. The flux density is proportional to the coil current (I) times a constant (k)." Sparling then derive various equations concluding that "if I is held constant, the induced voltage (E) is directly proportional to the average flow rate."

Now for the practicalities of the system. The Rosemount literature lists the following sources of unwanted noise: electrochemical voltage resulting from electrolytic reaction between the metal electrode and the ion-conducting liquid; inductive coupling of the magnetic field to the internal electrode wiring and the liquid; capacitive coupling of the coil voltage or outside power systems to the electrode circuit; transmission losses or phase shifts resulting from liquid impedance and transmission cable capacitance; stray voltage or current loops within the liquid.

The solution to some of these problems is to pulse the magnetising current at around five to 20Hz (depending on the manufacturer), rather than supply DC to the magnetising coils. There are other techniques used to minimise the effects of noise, including special grounding methods, ensuring a liquid velocity of several metres per second, automatic gain control (AGC), keeping conductor lengths as short as possible and so on.

So, while this technique is used commercially, it's clear such a flow measuring system is complex. The principle is simple enough, but realising a reliable working system takes quite a bit of doing. Before we finish this topic though, here's a thought from Graham Shepherd (via email), who brings us back to measuring the speed of a boat. He says:

> *Velocity measurement by thermal means, analogous to a hot wire anemometer is also possible, and would be easier to make. However it is non-linear and not very suitable for higher velocities.*

My thanks to all the readers who have contributed to this discussion, and my apologies if your letter has not been mentioned. Now to other reader letters, starting with one about a project in the February 2000 issue:

Screening phone calls

In February we published a project called a Phone Call Screener, a device in which callers you select can enter a four digit code from their phone, thereby setting off a buzzer to get your attention. However, as the following letter explains, Telstra can now offer as an optional extra a system which provides a degree of call screening.

> *I have just glanced through your 'Phone Call Screener' article and I thought you might like to know that much of the functionality the unit provides is already available on your home phone. I work for Telstra in the area where the Easycall type features are developed, and we have several features that overlap those of your device, including one we call 'Smart Ring'.*
>
> *This facility lets you sort your callers into three lists. When a call comes to your exchange, it compares the caller's number with these lists and if it finds a match, it rings your phone distinctively. List one gives one 400ms burst of ring every three seconds, list two gives two bursts and list*

THE INTERNET CAN BE A MARVELOU

three has three bursts. This system lets family members build their own list of callers so the appropriate person answers the call.

A list entry can include a partial number, e.g. if you enter 07 in the list, all calls from Queensland will ring distinctively. Add a few more digits and you can identify calls from a particular suburb. If you run a business from home, you can enter your regular customers into their own list so you can greet them with the business name. If you receive faxes from dedicated fax numbers, when you receive such a call the ring can alert you to set the fax machine to answer the call. There are also approved devices available (e.g. Dick Smith's Stealth Decoder) which can discriminate these rings and connect the call to a particular phone or answering machine, or fax for unattended operation.

In summary, you can have three lists of up to 30 entries in each. Full instructions are in the Easycall User Guide available at your local Telstra shop. The monthly fee is $4 and if you call 132 200 it should be made available within one working day. Your article hinted at controlling nuisance callers and apart from the above, Telstra also has other mechanisms in place or in development to deal with these.

There are lots of other features like these available on the Telstra network, with some getting a bit beyond the average user. One which might interest Internet users is a way of managing Call Waiting. As the pips can corrupt data packets, it's best to turn Call Waiting off before connecting to the Internet, requiring you to turn it back on after logging off.

*Sometimes you might forget to do this, but many Telstra exchanges have a feature allowing you to leave your Call Waiting turned on, with the exchange automatically turning it off when you log on, and turning it back on after you've logged off. To do this, prefix your ISP's dial-in number (in your modem setup) with *44. For instance, (03) 9290 0000 becomes *4403 9290 0000.*

(Graham Goeby, email)

Telecommunications is certainly becoming more and more sophisticated, as your letter points out Graham. I'm sure readers will be interested to know of the features you've described, but I'm not convinced these replace the Phone Screener project. There's one thing that the Telstra system assumes: you're prepared to leave the phone ringer switched on, which is not essential with the project. But otherwise Smart Ring seems a great feature, and one I was not fully aware of.

I've never been a fan of Call Waiting however, as to me it's a surefire way of having your phone conversations interrupted. But knowing how to automatically disable it for the duration of your on-line time is surely useful. So thanks Graham for telling us about this and other Telstra features.

SOURCE OF INFORMATION, BUT NOT EVERYTHING ON IT IS ABSOLUTE FACT...

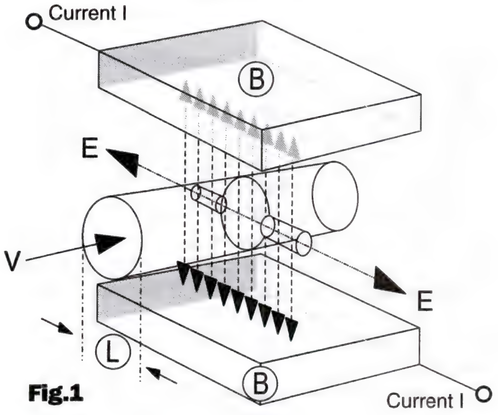


Fig.1

Mobile phone-Internet

Our next topic is also related to phones, but of the mobile variety.

I own an Audiovox MVX-605 cell phone which receives little use these days. I was wondering if there's a way to hook up a standard internal modem to it through the 'line' port of the modem so I can dial up the Internet on my home computer through the cell phone, instead of tying up the standard phone line. If this is possible, it will be much cheaper and less hassle than installing a dedicated phone line, since my ISP is dialled through a toll free number. I was thinking this could be done around the hands-free socket, but I am not sure how to go about this. Do you know if this is possible? (Michael Edwards, email)

I assume you are talking about a digital mobile phone Michael, and not a superseded analog type. In the first place, I doubt if your ISP will offer a toll free line for mobiles, and secondly, I wonder at the reliability of a mobile phone connection to the Internet. However, if we assume neither of these are a problem, have you asked about a second phone line? At the time of writing this, Telstra is offering a $75 second line using a newly developed "black box" that is installed at your premises. This box, in effect, gives you two phone lines, but with only one line back to the exchange. Telstra is pushing this as a way of reducing the "copper requirements" for the burgeoning phone system.

An advantage of this box, according to Telstra, is the likelihood of an improved data rate. As well, you'd definitely get toll-free calls, without the drop-out due to a poor mobile connection. As for using your mobile to send modem data, I suggest you contact an Audiovox agent. There could be a way, but without information on this type of phone, I'm guessing. Perhaps a reader knows.

Computer monitor surveillance

It's not often I get an email from a reader asking a question, followed by another from the same reader with an answer that's incorrect. See what you think...

I found the following on the Internet by accident while searching for glass break testers in regards to shop security. The site in question is

http://www.eskimo.com/~joelm/tempest.html, which discusses the possibility of others being able to pick up the radiation from your computer monitor and see what you are doing. The site claims: "The general principle is that computer monitors and other devices give off electromagnetic radiation. With the right antenna and receiver, these emanations can be intercepted from a remote location, and redisplayed (in the case of a monitor screen) or recorded and replayed (such as with a printer or keyboard)."

While you digest this, here's our correspondent's 'answer':

Just after sending my e-mail on monitor surveillance, I recalled as a teenager watching the ABC one day, and to my amazement an early video game of bat and ball tennis (really basic) appeared on the screen in a very ghosted format. I then realised it was my neighbor playing the video game on his television. So I've really answered my own question. Sorry about that! (Greg Freame, email)

The Internet can be a marvelous source of information, but not everything on it is absolute fact. A computer monitor, like any TV set, produces electromagnetic radiation, but this is predominantly due to the deflection circuitry, not the video section. You can see this on a CRO by simply holding a CRO probe near the set. The reason for this is due to the comparatively high power associated with scanning the electron beam.

Modulating the beam (to produce video) also requires power, but nowhere near as much as for scanning. Therefore, anyone wanting to "see what you are doing" would need to be (a) quite close by, and (b) own some pretty sensitive receiving/decoding equipment. However, I doubt even then that it's possible to use computer monitor radiation to re-create a picture of your activities. Has anyone ever heard of this being done?

As for your neighbour's video game appearing on your set Greg, I think you'd find the game was fed into the TV set via a video modulator. That is, the video information (including horizontal and vertical sync information) was first converted to an RF signal for input via the set's tuner. What you picked up on your set was simply the radiation from a poorly designed RF modulator, not the direct signal from the video game.

The RF radiation from a computer keyboard or printer would also be very small (particularly in these days of the C-tick), so again I doubt that it's possible for someone to pick up the radiation and use it to see what you are typing or printing. If this were so, I think we would have heard of such a thing by now.

Oscillating mast head amp

RF interference, apart from the sinister connotations mentioned in the previous letter, can also be a damn nuisance, as the next letter points out. Finding the source can be even more frustrating.

I live in a small town just north of Toowoomba in Queensland. Until recently we've enjoyed perfect reception from QTQ9 Brisbane from a closed dipole Yagi antenna, with a mast head amplifier. But, along with other residents in the area, all we now receive is a blank raster with no sound. A chat with an engineer from Channel 9 makes me think that a nearby mast head amplifier is oscillating at, or close to QTQ9's frequency of 196.25MHz.

Would it be possible to build a small directional antenna with an LC circuit tuned to 196.25MHz driving either a microvolt meter (possibly amplified with an MAR-6 or similar), or a portable 12V TV set tuned to Channel 9? If so, I might be able to locate the offending device. (J. Cooke, Crows Nest, Qld)

This is certainly possible Mr Cooke, but the design of the antenna would be tricky. I had the experience some time ago of trying to locate a source of RF interference from overhead power lines that was interfering with my TV reception. The electrical authorities tried on many occasions, but being an intermittent problem, they eventually gave up. I then wandered around the streets with a portable radio, eventually tracing the problem to a street transformer installation.

You might try something similar, using an antenna you know works for QTQ9 connected to a portable TV set. By working your way around the neighbourhood, you might be able to at least identify the area where the interference is coming from. To pin point the location will need a very directional antenna, probably a parabolic device. But if you locate the general area, it's possible the local electrical authorities will help, as interference problems are not new to these people. However, be warned: finding an RF source can be tricky, and generally requires sophisticated equipment. Good luck!

Electronic spare parts

The next request is one I can't answer, but I'm sure there are lots of others who can. It's to do with sourcing spare parts for electronic organs and the like.

I'm hoping you can help us. We are a small business specialising in a vast range of electronic equipment, including organs and keyboards. I'm having trouble locating Australian companies (excluding Yamaha) that deal with spare parts for such devices. We presently import these parts, but our customers often don't have the time to wait for them to arrive. (Simone Harris, Gizmo Electronics, Cairns, Qld)

About the best we can do Simone is ask our readership. If anyone can help, perhaps you might email Simone at gizmo@zoomnet.com.au.

Finding a blown bud light

I'm sure a lot of people will empathise with what the next letter is about: finding which light is blown in string lighting.

With the growing use of budlights, there's also a corresponding frustration when a globe blows somewhere in a string of 10 or 15 lights. Progressive removal and replacement with a good lamp is very labourious and difficult when the decoration is in place. So is there a simple way out, or can you design a simple handheld probe that will detect the break? I'm thinking of something like a Wattmaster Voltage Stick, which works fine on high voltages. In this case it would need to respond to low voltages of around 20-30V. If you can help, apart from creating a commercial opportunity, you would do much towards helping us have a happy Christmas. (Bill van Ommen, Burnie, Tas)

(continued on page 97)

EXPERIMENTING **WITH ELECTRONICS**

DARREN YATES

Opamp cookbook - 3

Darren Yates lines up some more practical opamp circuits for your scrapbook.

OPERATIONAL AMPLIFIERS are versatile and pretty easy to use — provided you know their limitations and don't expect them to do the impossible. That said, they really don't have too many limitations in most basic applications. It's only when you start wanting 0% distortion and tonnes of gain up into the GHz that you run into trouble.

One application where opamps work quite well is as comparators. A comparator is basically a function block that compares two voltages and gives you the answer at the output. If you've been used to computer programming, you can think of a basic opamp comparator almost as an 'IF... THEN... ELSE' statement like this:

IF the input at the non-inverting input is higher than that of the inverting input THEN the output will be high, ELSE it will be low.

Since many younger readers have grown up in an age of computers, it makes some sense to consider comparators in this light — it certainly helped me understand it better when I first learnt about them.

LED Level Meter 1

Our first two circuits this month show up this comparator action very nicely.

Most will have seen the LED VU meters on hifi cassette decks that show the signal level on the tape. The circuit in Fig.1 does almost the same thing but rather than working with a logarithmic scale (dBV), it shows up just a straight linear voltage change in an input signal.

In fact, with some suitable protection diodes, you could use this circuit to monitor your car's battery voltage.

As you can see, the circuit uses two LM324N quad opamp ICs. The DC voltage we wish to monitor is connected to the non-inverting inputs of all eight opamps via a 2:1 resistor divider.

The reason for the drop is that since the circuit is being supplied by the power source we want to measure, we need to drop to a more suitable operating point.

All of the inverting inputs are connected to a reference resistor string, which provides the voltage at each point for the corresponding LED to turn on. If we look at IC1a, the voltage on pin 2 will be:

Vpin2 = (56k/136k) x 8V = 3.29V +/- 5%

Remembering that we have halved the input voltage. If the DC input is 7V for example, it will deliver 3.5V to pin 3.

Now that pin 3 has a higher voltage than pin 2, the output of IC1a will go high and LED1 will turn on. If we look at IC1b, the inverting input voltage is set to:

Vpin6 = (66k/136k) x 8V = 3.88V

The DC input voltage to the non-inverting input is only 3.5V, so the output of IC1b stays low and the LED remains off. You can work the rest out for yourself but you should be able to see that the bottom LED is the only one lit in this example.

The circuit will monitor voltages between 7.6 and 16V in 1.2V steps.

You can change the lower, upper and incremental change voltage settings by adjusting the resistor string — I'll leave you to experiment with this.

LED Level Meter 2

The circuit in Fig.2 does the same thing as the first although with the difference that instead of a bar display, this circuit only has one LED lit at any one time. It relies on the differential voltage of the outputs by connecting the LEDs between outputs rather than to ground.

Let's assume that the input voltage is 8V. Notice this time that the DC input signal is connected to the inverting inputs and the reference resistor string to the non-inverting inputs.

Looking at IC1a, the inverting input is higher than the non-inverting input (4V *vs.* 3.29V) so the output remains low.

The same goes for IC1b (4V is greater than 3.88V). Since IC1b and IC1a have low outputs, LED1 and LED2 both remain off.

When we get to IC1c, the inverting input is now less than the reference point (4V vs. 4.5V) so the output goes high. Since IC1c's output is high and IC1b's is low, we have current flow and LED3 lights up.

You should be able to see that IC1d's output is also high, as is IC2a's and so on. The difference here is that

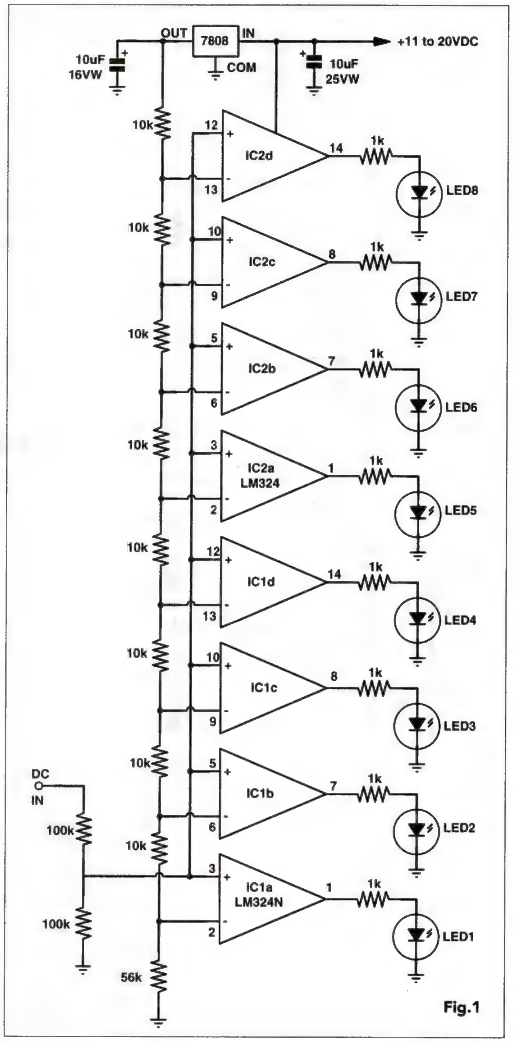


Fig.1

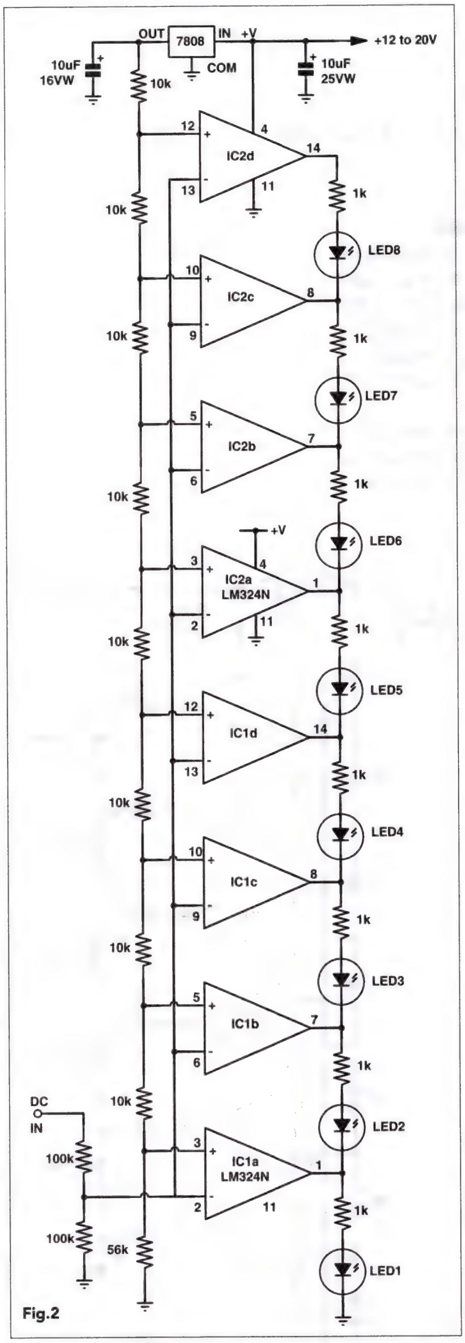


Fig.2

since both IC1c and IC1d's outputs are high, there's no voltage difference, no current flow and the LED stays off. This happens for the remaining upper sections of the string.

Both circuits work in effectively the same way but provide two different displays.

I've been a bit lazy in both of these circuits and used a 7808 8V voltage regulator. Even though these can be difficult to get hold of, hopefully you can see that you can use almost any 78xx voltage regulator from 5V to 24V and the circuits will work.

The only limitation is that as you go up in voltage, the output current drive of the opamps starts to exceed the recommended operating limits. Beyond a 12VDC supply make sure that you reduce the current-limiting resistors to the LEDs — 2.2k resistors should do the job.

You could also include the opamps in the regulated side of the circuit rather than just the unregulated section — it won't make much difference to the end results as most opamps have good power supply rejection (which means that variations in supply voltage don't have much of an effect on the output).

4-bit ADC

Analog-to-digital converters (ADCs) are the means by which computers interact with the real world and appear in digital multimeters and CD players, among other devices. They are generally quite complex beasts but using two ICs we can make a simple 4-bit ADC shown in Fig.3.

IC1 is an LM358 dual opamp IC while IC2 is a 4029 CMOS 4-bit programmable up-down counter. Now you're probably thinking "how can we converted an analog input to a digital output when there's no special IC involved?"

Quite simple.

We actually build a **digital-to-analog** converter connected in a negative feedback loop controlled by an input voltage to give us the digital output.

OK — that's a bit of a mouthful, but follow the circuit and you should see how it works.

IC1a forms a very simple square wave oscillator running at... well... it doesn't really matter what frequency at this stage — just so long as it works.

If you read up more on the theory of ADCs, you'll discover that the maximum frequency this circuit will handle is half the clock frequency — this is all part of the Nyquist theorem but we'll leave that for another time.

IC1a just makes sure that IC2 keeps ticking over. IC1b on the other hand is set up as a comparator and is really the crunch part of the circuit. IC2 forms our four-bit DAC. Actually, the resistor string connected to the four-bit output does.

Note that all of the programmable inputs and the clock enable are connected to ground — it won't work otherwise.

What happens here is that the clock generator IC1a clocks up IC2. As this happens the four-bit output rises in a binary fashion — 0000, 0001, 0010, 0011, 0100 etc.

Now on the output we have a series of resistors that convert the digital output into a DC voltage. We feed that DC voltage into the inverting input of IC1b and the DC voltage we wish to convert into the non-inverting input.

The four-bit digital output gives us 16 separate levels, as you'll find out if you carry out the full four-bit binary count started above. Now since our supply voltage is 8V (I've chosen this for simplicity), each digital number gives us a 0.5V step (i.e. 8V/16 steps = 0.5V per step).

With the counter starting off at 0000 and the DC input voltage at 3.6V, IC1b's output will remain high, allowing IC2 to count up. Once it reaches the digital code 1000, the DC voltage from the resistor string will reach 4V, the inverting input is now higher than the non-inverting input and the output of IC1b goes low.

As this output is connected to the up-down control of IC2, this switches the counter from 'up' to 'down' so on the next clock pulse, the counter will go from 1000 back to 0111. But this drops the DAC voltage on the resistor string to 3.5V. That's below the 3.6V DC input voltage so IC1b's output goes high, telling the counter to count up again. What happens in the end is that the circuit will oscillate with the digital code jumping between 1000 and 0111. Change the DC input voltage and the digital output will change.

It sounds complex but you'll see it clearly when you build the circuit up — after all, we're on about experimenting anyway!

While this isn't exactly how the ADC in your CD player works, it's not too dissimilar. In fact, with a little tweaking and the right software, you could turn this into a simple and crude voice recorder for your PC.

Actually, I'd think about adding an audio frequency filter on the front end with a cut-off frequency at least two octaves below the clock frequency i.e., if the clock runs at 20kHz, set the audio filter frequency to about 2.5kHz.

CD players use a 44.1kHz clock but still manage to sample at up to 20kHz through the use of digital filtering techniques. Since the Nyquist frequency in this case is only 22.05kHz, there's only 2.05kHz of room to filter off the audio to ensure you don't hear any clock interference.

The filters used in this case are often called 'brick-wall' filters for obvious reasons...

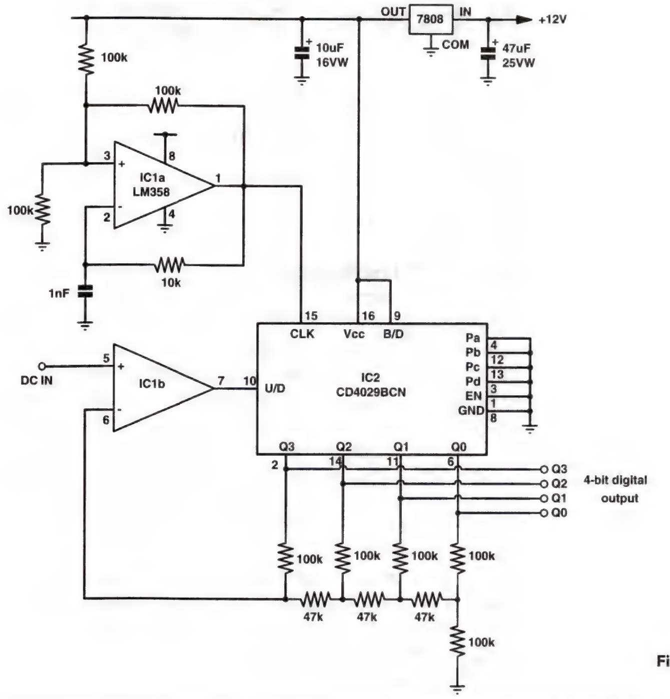


Fig.3

Sine-wave oscillator

The last circuit showed you how to create a simple square wave oscillator but opamps are also very useful in creating sine wave oscillators too. Sine wave oscillators are very useful devices, particularly in measuring total harmonic distortion in audio power amplifiers. They're also used in radio transmitters as well (among other places).

The output signal from this circuit in Fig.4 may not be good enough to test your $2000 audio power amplifier but it does show you the versatility of an opamp.

Looking at the circuit, all it uses is a single opamp and a handful of components. If you have an old LM741 opamp lying around, this is the perfect circuit to use it on.

For a circuit to oscillate, it needs positive feedback. (Those of you who have built audio amplifiers will know that this is not hard to generate). IC1 uses a Wien Bridge formed from resistors R1 and R2 plus caps C1 and C2 in its positive feedback loop, while providing a gain of just over three though the negative feedback path.

Remember that the gain of a non-inverting amplifier is **1 + (R3/R4)**. The important thing here is that we don't want too much gain otherwise we'll have square waves everywhere. You need just enough gain to make the circuit oscillate — and that's all.

The theory behind the Wien Bridge oscillator is that it only needs a gain of three to start oscillating. Another common sine wave oscillator is the phase-shift oscillator but it requires a gain of 28 to start.

The more gain the opamp has to deliver, the lower the maximum oscillating frequency.

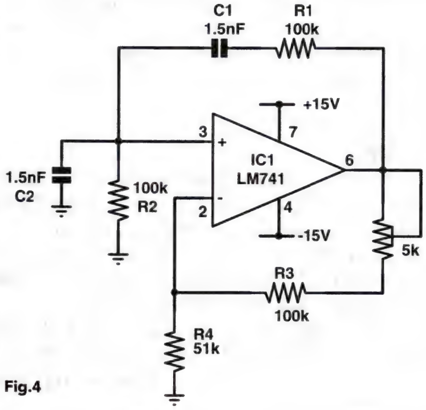


Fig.4

The frequency of the sine wave equals **1/ (2 x π x R x C)**.To see this circuit operating, you really need a cathode-ray oscilloscope (CRO) or a PC sampling CRO kit capable of sampling frequencies of at least 5kHz. (We've set the frequency to approximately 1kHz in this circuit.)

Now when you build this circuit up, you'll find that it is very difficult to get it to produce a steady-amplitude sine wave — it will either stop or take off into a square wave (I'm warning you now so I don't get hate-mail next month...) It's important that you learn about this aspect of positive feedback — a lesson learned now will save you hours of debugging circuits in the future.

Now there are ways to control this and we'll look at them in more detail next month. If you're keen to try and figure it out, one way is to use diodes and another is to use 'grain-of-wheat' light-bulbs. See if you can figure it out before next month.

OK, that's enough for now - we'll pick this up again next time. ■

Record Keystrokes on PC in hardware

NEW!

Keystrokes stored in Flash RAM

Record keystrokes in hardware with tiny KeyGhost device. Looks like an ordinary keyboard extension cable with EMC balun. Simple to use, no software to install, just plug it in. Completely undetectable with software. Keystrokes can be retrieved on any PC.

WWW.KEYGHOST.COM

VINTAGE RADIO

BY ROGER JOHNSON

A Power Supply for Small Receivers

Although a very fine bench power supply for vintage radio was described in this column some years ago, many enthusiasts are now having difficulty finding the right power transformer for it. This month we give construction details for a flexible alternative supply which should assist.

ONE OF THE PROBLEMS that vintage radio enthusiasts have faced recently in building the power supply described by Peter Lankshear a few years back is the availability of a suitable power transformer. Unfortunately there is no one transformer that is going to fit the bill, but with the availability of small low cost transformers from the major electronics supply chains, it is possible to press two, or even three into service.

The aim of this article is to describe a power supply that can be built as a 'one-off' for a specific battery powered radio, yet remains flexible in its design so that it is suitable for other applications.

The new power supply is primarily intended for the plethora of 1.5 volt and 2.0 volt battery powered radios requiring 90 volts HT for the 1.5V valves and 135V for the 2.0V valves, respectively.

Radios using the later 1.5V series invariably dispensed with a grid bias battery. 'Back bias' or 'self bias' was incorporated into the circuit. The older series 2.0V valves may have required a grid bias battery. Some did, some did not. AWA receivers in particular had a chassis mounted grid bias battery.

The vast majority of four or five valve battery superhets chose the 1D4/1L5-G for the output valve, which requires only -4.5V bias for full operation. It would work quite satisfactorily on -6.0V with a saving in current drawn from the 'B' batteries.

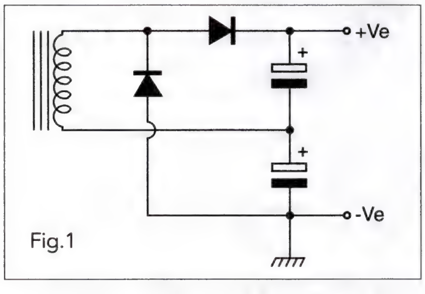
In the circuit described, grid bias of up to -4.5V is obtained by the supply's own 'back bias' system, at the expense of total HT available. In so doing the cost and associated wiring of a third power transformer has been saved.

Power transformers

A transformer with a secondary of 120V or so at about 50mA would be ideal, but they are not easy to find. Or cheap, if you can find them...

A power transformer from a discarded valve chassis has its own problems. Firstly, there is the size and associated mounting problems. More importantly, though, is the fact that the secondary voltages are far too high. Even 280V a side poses problems, and the old 385V-0-385V jobs are simply out of the question for this project. The biggest problem is divesting the large voltages that need to be dropped in order for the valves to work at 90 to 135 volts HT.

Fig.1: The full wave voltage doubling rectifier circuit which was popular towards the end of the valve era.



To buy a new transformer capable of being used to deliver the required voltages, requires something a little unorthodox in vintage radio terms.

Voltage multipliers

Towards the end of the valve era, 'voltage doubler' rectifier circuits incorporating silicon diodes were used instead of the hefty valve rectifier (Fig.1). The extension of the voltage doubler is the *quadrupler*, and that is the circuit that we're using here. The circuit is shown in Fig.2.

Basically, this type of circuit involves successive charging of the storage capacitors, via the duty cycle and polarity of the diodes, such that C4 is constantly under charge whilst a load is being drawn from it. The voltage at C4 is the transformer voltage plus the stored voltage in C3, which is charged up to three times the transformer voltage, by 'charge pump' action via C1 and C2 — charged at one and two times the transformer voltage respectively.

The performance of this type of voltage-multiplying rectifier boils down to getting as large a capacity as is possible and practible, especially for C4. The higher the load current, the greater is the capacity required. 47uF is about the minimum for this project.

The recommended voltage ratings needed for capacitors C1 to C6 respectively are tabulated alongside the circuit. C2 should have a rating of at least 90V, but you could use either a 250V unit or connect two 100uF/63V units in series, with a 27k resistor in parallel with each to ensure they share the voltage drop equally.

47uF/250V electrolytics are available (Cat No. 267-4906) from RS Components, which has warehouses in most capital cities. This firm also stocks a 47uF/100V unit Cat No. 267-4827), which could be used for C2.

Jaycar Electronics stores also stock 47uF/450V and 100uF/450V electrolytics, as well as 47uF/63V and 100uF/63V types which could be used for C1. The 450V units could be used for C4-6 if you can't get 250V capacitors.

Regulation

The output from the basic voltage-multiplying rectifier circuit across C4 in Fig.2 has a way to go before it can be used. Superimposed on the high voltage DC is a mighty fine sawtooth waveform, of considerable amplitude. However with sufficient filtering and zener diode regulation, the end result is quite satisfactory.

To begin with, filter resistors R1A and R1B are most important, together with filter capacitors C5 and C6. Zener diodes ZD1-4 are then used to regulate the output.

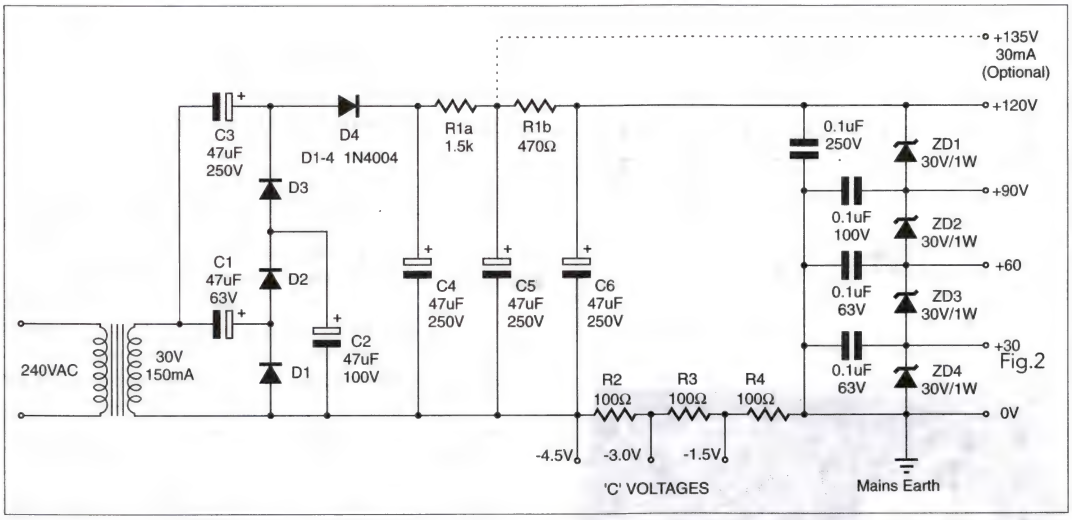


Fig.2: The final circuit for the 'B' and 'C' sections of the author's supply, giving a range of HT and bias voltages. As you can see it uses voltage quadrupling to provide up to 135V from a 30V transformer.

The value of the filter resistor must be within quite defined limits. When using a proprietary line transformer such as the MM2007 which is rated at 150mA, we must consider the overall secondary power, and tailor the secondary current accordingly. As we are asking this transformer to deliver four times the voltage, the current can only be one fourth of the rated value. This limits the current to 38mA, which in this case is more than the amount drawn by the zeners.

Depending on the value of capacitors and the value of the filter resistor, slightly more that 120 volts may be available at the output. In any event, after filtering, 120 volts is available for the supply. For a radio requiring 135 volts, this slight reduction will not make a scrap of difference.

The filtering is most important. Initially, 200mV ripple was produced, which was considered high. With the circuit shown the two-stage RC filter delivers an almost negligible 25mV under full load of 14mA. The resultant bleed current is 17mA, well within the limits of the transformer and the zeners.

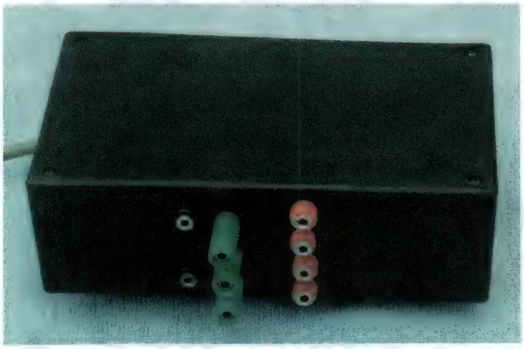
The small resistors R2, R3 and R4 provide a small voltage drop in the negative rail of the supply to allow for grid bias. The '0V' reference is taken from the junction of R4 and ZD4. The bias voltages are -1.5V, -3.0V and -4.5V, which will suit any set requiring -1.5V for delayed AGC and -4.5V bias for the output stage.

To increase the flexibility, the values of these resistors can be increased to produce higher bias voltages. The calculations are simple enough, so I'll leave them to you.

The filament supply

So far, of course, we've only considered the HT and bias supply. Now let's turn to the filament supply. Here a separate transformer is used, together with an LM317 variable regulator (Fig.3).

By the way these devices are NOT indestructible, despite what may be claimed, and they do run hot. The higher the voltage differential between input and output, the hotter they run. Despite being rated at 1.25 amps, the closer the load current to the maximum and the closer the output voltage to the input, the more likely they are to both fail to deliver the required output voltage, and also to generate substantial ripple.



The author's completed prototype supply, housed in a low cost plastic jiffy box. It's likely to cost between $40 and $50, depending on the options you want.

When you're working out the transformer secondary voltage needed for this supply, remember that for all practical purposes, the raw DC after rectification will be the peak voltage of the transformer secondary (about 8.9V), less two diode drops from the bridge rectifier (1.2 volts) and at least 2.5 volts which must be allowed for 'headroom' in the regulator chip. So with a typical 6.3V/1A transformer, the maximum output is around 4.0V.

This has been borne out in practice. Under heavy load, about 0.75 amp, the device then will fail to deliver even 4.0V (with the 6.3V AC input) and heavy ripple appears on the output. However, for a 1.5V or 2.0V output, a 6.3V transformer such as the Jaycar MM2002 should be fine.

The regulator should be fitted with a small heatsink, or at least mounted on a suitable area of copper on a PCB. This has been done in the prototype shown in the photos, and it's a wise precaution.

The LM317 regulator is usually used with a variable resistor to set the feedback voltage, and hence the output voltage. However some people (myself included) have a preference for a switched voltage, instead of a continuously variable output; but herein lies a snag.

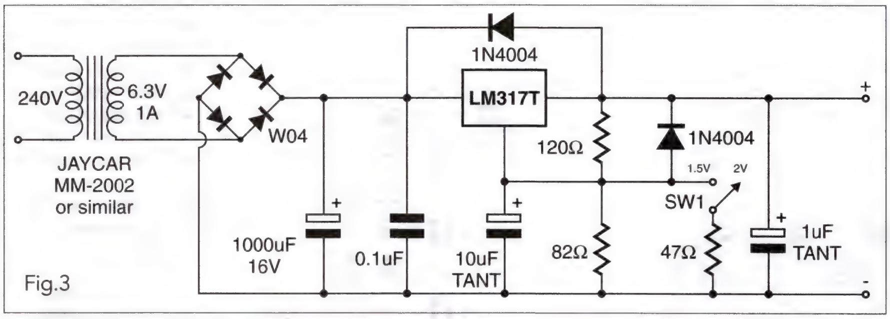
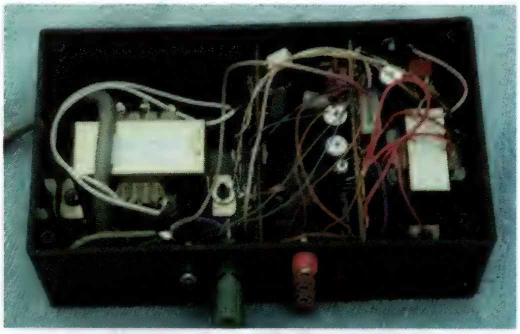


Fig.3

Fig.3: The low voltage filament or 'A' supply, delivering regulated DC of either 1.5V or 2.0V at up to about 750mA.



Inside the prototype, showing the two transformers and the two separate stripboard assemblies — one for the HT/bias supply and the other for the filament supply.

During the interval when the switch wiper passes from one contact to another to select an appropriate resistor, there is no feedback voltage applied to the device. Experience has shown that this action could have a deleterious effect on the device, and may explain the reason why they unexpectedly fail. When I changed over temporarily to a continuously variable output, the problem didn't occur.

For this project, a simple toggle switch connecting a shunt resistor across the lower divider resistor has been used. This allows the output to be set to either 1.5V or 2.0V with no problems. The upper divider resistor is the standard 120 ohms, with the lower resistor 82 ohms for 2.0V and shunted down to 27 ohms (via the 47 ohm resistor) for 1.5V.

Strictly speaking the 1.5 volts should be 1.4 volts, but as these valves were intended for dry batteries whose terminal voltage when new is 1.56 volts, any figure between 1.4 and 1.5V should suffice.

Construction

The project has been designed to fit all components into a 197 x 113 x 63mm jiffy box. Two PC boards could be used, or if you wish it can be built on 'stripboard' like the prototype. Whichever is used should slide vertically into the locating grooves.

The zener diodes will get hot. Half-watt types are specified, and it is a good idea to leave the leads as long as possible (say 1") to allow the passage of air to cool them a little. To this end, it may also be a wise precaution to drill ventilating holes one each side of the box, and one or two 6mm holes in the top as well.

As for the terminations, there is a good deal of flexibility. If it is to be used for a specific receiver, the battery leads of that receiver may be hard wired. However, as many constructors may wish to use the supply to power a variety of radios, the terminations can be to a variety of coloured banana sockets conveniently mounted. The number may depend on your degree of flexibility. A suggested set would be B- (black) and a set of four red sockets marked B1+ (30V), B2+ (60V), B3+ (90V) and B4+ (120V) respectively. The filaments can be red and black, placed near the 1.5V/2.0V toggle switch.

The grid bias can be in the conventional colours of C+ (white) and then three green terminals marked C1- (-1.5V), C2- (-3.0V) and C3- (-4.5V) respectively.

Remember also to secure the incoming power cord with a suitable clamp. The mains earth wire should be connected to the frame/mounting flange of each transformer, and also to the B-/C+ output terminals.

Flexibility

The circuit for this supply is more flexible than you might think. For example should 4.0V or 6.0V filament power be required for the much older sets using those series of valves, you can achieve this quite easily by changing resistor values in the regulator circuit of Fig.3. The lower divider resistor is increased from 82 ohms to 470 ohms to give just over 6.0V of output, while the

(continued on page 97)

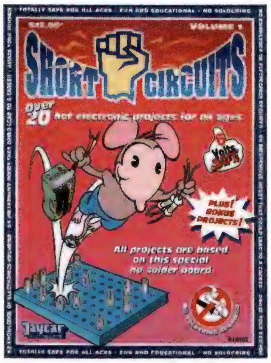
PRODUCT SAFETY RECALL

SERVISOL AIR BRUSH AIR DUSTER 250gm AEROSOL CAN

DPI Aerosol Pty Ltd the contract packer for the above Jaycar Electronics product has detected a fault in the crimping of the valve for the above product with the distribution dates-

06/08/99 and **09/08/99** - stamped along the can bottom rim. If exposed to extreme heat, vapour pressure may cause the crimp to give way and possibly cause injury. All cans with these batch dates, whether full or partially used, should be emptied (in temperatures of less than 35 C) by inverting the can and, placing the nozzle with the outlet facing away from you, on a hard surface in a well ventilated area eg concrete driveway, and pressing down on the can to release, COMPLETELY, the contents and the empty can disposed of in the normal manner. Alternatively the cans should be stored in a cool place away from direct sunlight, all heat sources and persons and returned to the nearest Jaycar Electronics, or agents, outlet for immediate refund, taking great care to minimise exposure of the cans to excessive heat whilst returning the product.

Further information can be obtained by phoning Estelle Rogers -DPI Aerosol Pty Ltd- on (02) 9603 8017 or Mark Harris -Jaycar Pty Ltd- (02) 9743 5222


SHORT CIRCUITS
over 20 hot electronic projects for all ages
Volume 1
PLUS! BONUS PROJECTS!
All projects are based on this special no solder board
Jaycar

Book & kit make

First steps easy

Whether you're young or not-so-young, the 'hands-on' approach makes learning electronics a lot easier. Jaycar's Short Circuits 1 learning system combines a lavishly illustrated book with a no-soldering wiring system, allowing the newcomer to build up 24 interesting, safe and educational projects — and also have fun in the process. **By Jim Rowe**

ELECTRONICS MAKES a fascinating and rewarding hobby, and can provide a very satisfying career as well if you decide to take it further. But like other pursuits based on science and technology, it can be a bit intimidating for newcomers — probably because there are so many aspects to get familiar with, before you can make much progress.

Over the years, though, one approach has proved to be particularly successful: the 'hands on' or 'learning by doing' approach. It's amazing how much more easily the basic concepts fall into place when you build up some simple projects, and experience the adrenalin rush that comes when they spring into action.

Unfortunately even building up simple learning kits was a bit daunting in the old days, because it generally involved weilding a soldering iron to connect the components together — and soldering involves skills of its own.

Happily, Jaycar's kit-based Short Circuits learning system gets around this problem very neatly by using a no-soldering wiring system, based on specially designed spring clips which push into holes in a perforated plastic baseboard. The clips allow very easy connections to be made between components, with essentially no tools whatever.

Helpful book

Along with the clips and baseboard, the other key part of the Short Circuits system is the matching book, which apart from anything else provides a full set of wiring-guide 'baseboard overlay' diagrams, one for each of the projects. These are exactly the same size as the baseboard, so by either cutting them out or making a photocopy, you have a very easy to follow template showing exactly where to fit the spring clips needed to provide that project's connection nodes — plus, of course, a guide to placing the components themselves.

The book also provides both a very clear perspective wiring diagram and a schematic for each project, along with step-by-step assembly instructions, a parts list, and even a 'Tech Talk' section which explains in simple terms how it actually works.

As you might expect, all of the book's 24 projects are battery powered and operate from 6V or less, removing the risk of shocks altogether and making the projects very safe for beginners.

A particularly nice feature of the book are the cartoons used to introduce each project and the matching icons which identify the 'Building It' and 'Tech Talk' sections for each. These were all done by the multi-talented Australian cartoonist Brendan Ackhurst, and really boost the 'friendly fun' aspect of both the book and the Short Circuits concept as a whole.

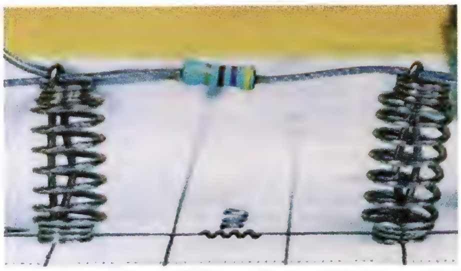
As for the projects themselves, they include a LED Flasher, an Electronic Buzzboard, a Continuity Tester, a Light Alarm, an Electronic Die ('Heads or Tails'), a Two-Transistor Siren, a Mini Organ, an Audible Moisture Indicator, a Morse Code Transmitter, a LED Chaser, a Motorcycle Sound FX generator, a simple AM Radio, a Sound-Triggered LED, a Touch-Operated Switch, and so on.

***Above:** Connections are made with small spring clips that plug into the plastic baseboard.*

At the rear of the book, along with the baseboard templates, there's also a clear explanation of resistor colour codes and capacitor marking codes, plus a complete set of identification drawings for every component used in the projects, with a supporting text explanation. (These drawings were also done by Brendan Ackhurst and they're particularly clear.)

It's all very well done, and I'm not surprised that the Short Circuits book and matching kit of parts have proved very popular with schools and colleges, as well as beginning hobbyists. Together they provide an excellent way for newcomers to 'dip their toes' into the wonders of electronics, in an enjoyable and hassle-free way. And of course it has all been designed and published right here in Australia — a credit to all concerned.

The Short Circuits book and a complete kit of parts for all 24 projects (Cat. No. KJ-8502) are available from all Jaycar Electronics stores and dealers, for only $29.95 RRP. However the book itself is also available separately (BJ-8502) for $12.95, with the kit of parts available separately (KJ-8504) for $19.95. ■



***The printed overlay** makes it easy to wire-up your circuit. As there's no soldering, components can be re-used from project to project.*

$10 WONDERS

BY OWEN BISHOP

Weekly timer

All too often on Friday mornings we awaken early to the sound of revving diesel and the clatter of cans and bottles as the garbage truck drives by. And, once again, we've forgotten to put the wheely bin out! AAaaarrrggg!!! Build this weekly timer and you'll never forget the bins again...

DO YOU FORGET to put the bins out? Its no good looking along the street each evening to see if the neighbours have put theirs out — I've tried that, and I'm convinced that they all sneak out with their bins after dark on the previous evening just to confound me.

If so, here is the answer to the problem: a timer that counts the days and warns you in good time to put out the bin. You could, of course, use it to remind you of any other event that occurs every few days, such as a visit to the gym, or the golf club. Or as a reminder to switch on your favourite weekly TV show. The alarm comes on at dusk, which is the time of day at which you are most likely to need a reminder.

Inexpensive timers with long periods tend to suffer from lack of precision, but this one employs a highly accurate timekeeper — the Sun. The earth spins once on its axis every 24 hours and, though the length of the day is said to be steadily getting longer owing to gravitational forces, this is of no concern. As long as we continue to regulate our activities by the rising and the setting of the Sun, this timer provides all the accuracy that we require.

How it works

The timer detects the coming of dusk by the fall in light intensity. A light-dependent resistor (Fig.1, R1) is sensitive to the amount of light falling on it. Its resistance is a few megohms in darkness but falls rapidly to only a few hundred ohms in the light. In the light, R1 has a much lower resistance than R2, so the voltage at point A in Fig.1 is high. In fact, it is nearly 6V in bright light.

As dusk falls, the resistance of R1 increases to a high value, and the voltage at A drops to a few hundred millivolts. This means that Q1 is turned on by day but is turned off at night. The effect of this is that the voltage at B is low by day and high during darkness.

The voltage at B is fed to the clock input of the 4017 counter (we will discuss the role of R4 and the large-value capacitor in a moment). The counter is rather an unusual type because it has 'one-of-ten' outputs. It has ten output pins but only one of these can have a logic high (6V) output at any one time. The rest are all at logic low (0V).

When the counter is reset by briefly pressing S1, output 0 goes high and the other outputs are low. The next time the clock input goes high, which is at the next dusk, the counter is incremented by 1; output 0 goes low and output 1 goes high. There is no change on the following morning because the counter is triggered only by a rising edge (i.e. it increments as the sun sets, not when it rises). The following evening the clock input goes high again, so output 1 goes low and output 2 goes high — the counter is counting the dusks. The count continues until dusk 6, when output 5 goes low and output 6 (IC1, pin 5) goes high. This turns on the transistor Q2, and the LED is lit.

The garbage trucks come around on Fridays

PARTS LIST

resistors	
(5%, 0.25W, except for R1)	
R1	light dependent resistor, DSCD01 or similar.
R2	68 k
R3, R5	100k
R4	1k
R6	10k
R7	22k
R8	390 ohms
capacitor	
C1	1000uF 16VW electrolytic, axial
semiconductors	
D1	light emitting diode (see text)
IC1	4017 decade counter
Q1, Q2	BC548 NPN transistors
Miscellaneous	
Push-to-make pushbutton, stripboard 35 x 82mm (13 strips x 31 holes), 4 x 1mm terminal pins, 16-pin IC socket.	

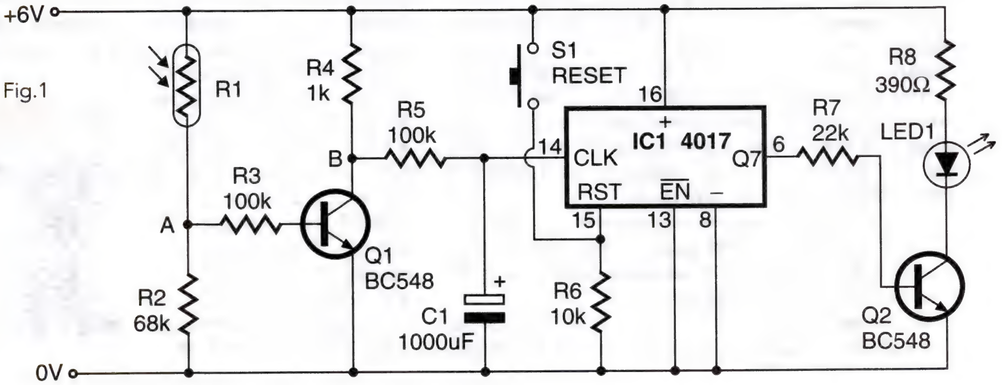


Fig.1

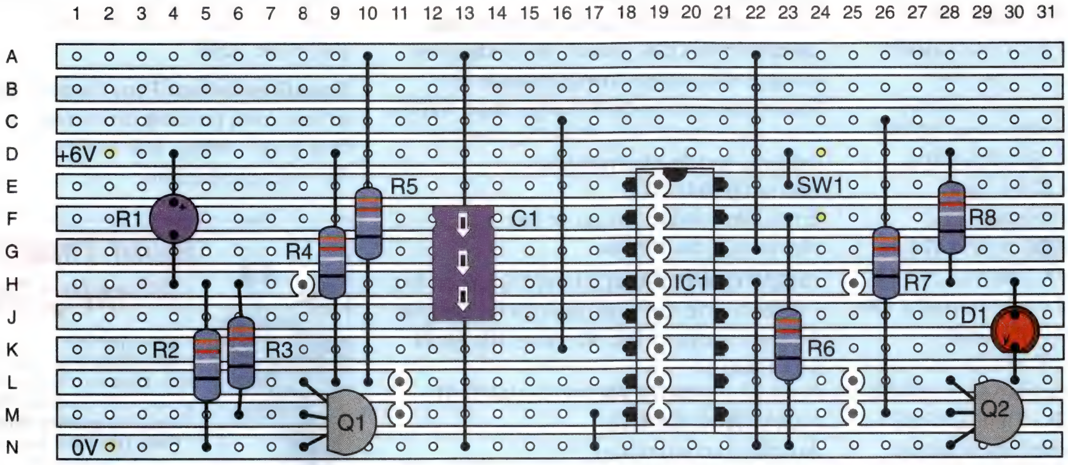


Fig.2

***Fig.2:** So long as you remember to cut the tracks at H8 and H25, you shouldn't have too much trouble constructing the Weekly Timer. The LDR (R1) can be mounted on the board, or on longer leads.*

in our suburb. If we reset the counter on a Friday at any time during the day, the counter is reset to 0. Then it counts 1 on Friday evening, 2 on Saturday evening, and so on to 6 on Thursday evening. This just the moment to put out the bin ready for the early call on Friday morning. We reset the timer as we put out the bin or at any time during Friday.

Kept in the dark

One of the problems with the circuit is that it must be kept in the dark all night. A headlight beam from a passing car or a flash of lightning could make the counter think that a new day has dawned and would soon get ahead of the true timing. To avoid this we put a low-pass filter with a very low cut-off frequency between Q1 and the counter. With this in place, it takes about 2 minutes of continuous light to make the counter think it is dawn.

Obviously, the counter must not be operated in a room that is lit at night. One important point is that the circuit is sensitive to low light levels and will easily operate in a shaded place, as long as a little daylight gets there. If you put it close to a window or, worse, where it receives direct sunlight, the resistance of R1 falls and the current through R1 and R2 rises. This leads to excessive discharging of the battery.

Bathing the baby

With reference to our recent project, the Electronic Elbow, reader A. N. Brooks of North Mackay sends us some helpful information. Apparently, it took him a lot of searching of the baby-care literature to find that the correct temperature for the bath is 37°C. This is the normal temperature of the human body. Therefore, when you place your elbow (very sensitive) in the bath, the water should feel neither hot nor cold.

The Electronic Elbow could be set to limits one degree on either side of 37°C, by immersing the probe in bowls of water at 36°C and 38°C and setting the trimpots accordingly. Leave baby in the bath as long as both LEDs are lit. Eventually, one or the other will go out (which one depends on where you live in Australia and on the season). When that happens, it is time for baby to come out too.

Construction

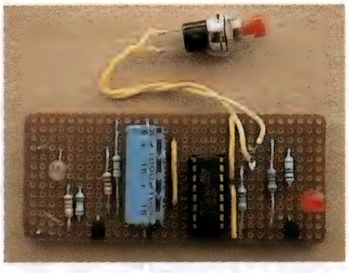
The circuit runs on 6V provided either by four 'D' cell batteries or by a 6V mains adapter. It can be housed in a small Jiffy box with a hole in the lid to admit light. There is no need to mount the LDR on the lid. In fact, it is better to let only a small amount of light fall on it, so as to conserve battery power. The circuit is easily assembled, but do not include the capacitor in the circuit until after the circuit has been tested. Testing takes too long with the capacitor in place, as the response is very slow.

The LED can be mounted on the board, as in Fig.2. Alternatively it can be mounted in a hole drilled in the case. Insert terminal pins at H30 and L30 and run short leads from these to the LED. Similarly, the pushbutton is mounted on the case with leads connecting it to the pins at D24 and F24.

It is helpful to measure voltages at A and B when testing. In the light, even in dim indoor light, point A should be close to 6V, (say 5.8V), while B is only a hundred or so millivolts (nearly zero). In the dark, A is at about 450mV (it must not be more than 600mV or Q1 will be switched on), and B is at about 5.8V. The counter is triggered as the voltage at B rises above 3V. If you find that you do not obtain these voltages it may be that your LDR is different from the one specified. Try a resistor of different value for R2.

The prototype has an ordinary LED as indicator. If you prefer, you could employ a flashing LED. This costs more, but the total cost is still within the $10 limit. If you do this, omit R8 because flashing LEDs don't need a series resistor.

This article describes just one use for the circuit, but readers may have several other ideas. If you need other timing periods, connect R6 to one of the other output pins. 1 = pin 2, 2 = pin 4, 3 = pin 7, 4 = pin 10, 5 = pin 1, 6 = pin 5, 7 = pin 6, 8 = pin 9, and 9 = pin 11. ■



***The finished timer** will be best off mounted in a box, and kept in a low-light environment to reduce battery drain.*

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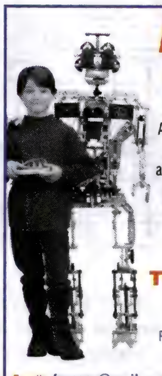

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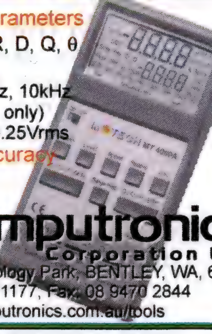

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INFORMATION **CENTRE**

continued from page 86

As you say Bill, finding a single blown globe in a string can be tricky, as the only electrical clue is that the supply voltage will appear across the open circuit globe. We haven't even thought about a low voltage detection wand project, but I wonder whether it's even possible. After all the electrical field (which is all you get in this situation) is quite small, due to the low voltage. As well, it would be affected by the electromagnetic field caused by the current flowing in other sections of the string.

However, a way you might not have thought of is to use a meter fitted with probes that can pierce the plastic insulation, letting you get at the connections to a globe and measure the voltage across it. You could make such a probe with a pin or needle, although commercial probes are available. The hole you make in the insulation might let moisture in (if the lights are outside), but this is not a problem for inside use.

What??

Here's a simple, non-mathematical question. It comes from Phil Ereaut who I guess teaches electronics. Phil asks:

> *An electronics teacher wants to show the class what a sine wave looks and sounds like. All he has is a CRO, an amplifier system and a microphone. How can this be done with no additional equipment?*

Answer to April

A total length of 1273.24kms. The length of the wire is found by dividing its cross sectional area (csa) into the volume of the copper block. The volume of the block in millimeters is 1000 x 1000 x 1000 = 1 x 10^9mm^3. The csa of the wire is pi x radius squared, or 3.1416 x 0.5 x 0.5 = 0.7854mm^2. Dividing csa into volume, then dividing by 10^6 (to convert to kilometres) gives the answer. ■

VINTAGE **RADIO**

continued from page 92

nearest shunt resistor value for 4.0V is 560 ohms (which should give about 3.9V). Alternatively, a 1k trimpot may be used for more accurate adjustment. The 12.6 volt tap will need to be used on the transformer, and the remainder of the circuit remains the same.

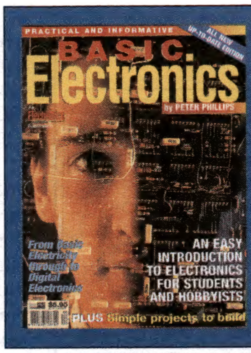
As long as the filament voltages are within +/-0.1V to 0.3V, depending upon the value chosen, all should be well. It must be remembered that these radios were originally powered by lead-acid accumulators, and one cell fully charged was 2.2 volts. The radios generally 'gave up' when the battery terminal voltages fell to something in the order of 60% of the fully charged 'new battery' value. So the tolerance is reasonably wide.

There's only one real precaution: DO NOT run the filaments of 1.5V valves at ANY HIGHER than 1.5 volts. They simply will not take it!

As another variation on the supply, people wishing to experiment with one- and two-tube receivers using indirectly-heated 6.3V/0.3A 'AC' valves such as the 6SN7 twin triode might be able to use just an MM 2002 transformer alone, to provide an economical 'single power pack' for both the heater power and HT. (As the transformer is rated at 1A, though, it would not be wise to run more than three heaters.)

The full 15V secondary voltage can be connected to the voltage quadrupler, and with only two 22V zeners you should be able to obtain 45V to run one of these little receivers for headphone use. Although the 0V will be common to both the heater and HT supply, this won't be a problem using indirectly heated valves. Of course you won't need the filament rectifier or regulator for these valves.

Depending on what one can find in the junk box, the cost of this little project may be as low as $40 for the two power transformers, jiffy box, regulator and heatsink, stripboard and the higher voltage electros. Have fun! ■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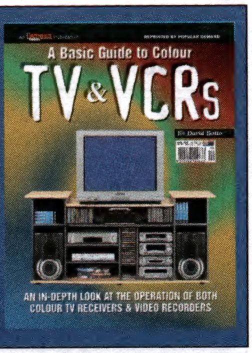
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BY DARREN YATES

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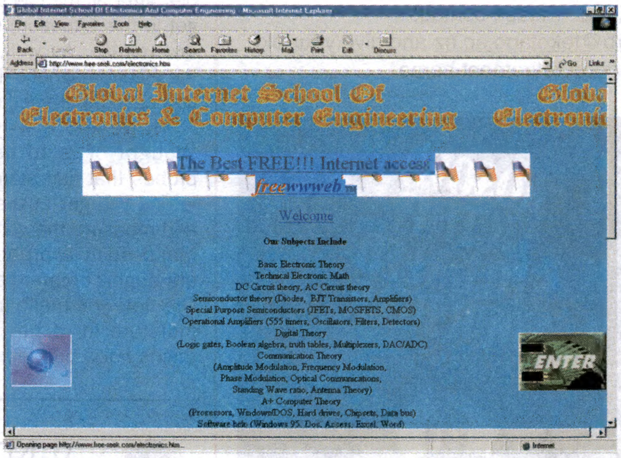
The claim is that this site will soon have over 1200 bits of free downloadable technical gee-wizardry. The references to 110/120VAC, which could cause just a few problems, the rest of the site looks harmless enough. Subjects include transmission line theory, basic DC circuitry theory, JFETs and MOSFETs and digital circuits.

It won't substitute for a university degree but there is some generally useful stuff there.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ONE OF THE dying arts of the electronics game is making your own printed circuit boards. And while it is actually quite easy to do if you have access to a controlled ultraviolet light source, many hobbyists have been tinkering around with a simpler solution using transparency film and a hot iron.

You can find one such recipe at **www.eng.uci.edu/~rshah/pc-board.html**. The whole idea is to transfer the laser toner from the film onto the printed circuit board material — some have good results, others not so good. If you're a beginner, this probably isn't the best site for you as it assumes a fair bit of knowledge anyway.

FROM THE 'it had to happen eventually' department, MP3 is now making an appearance in a car near you! No, we're not talking about one of those horrible little MP3 players *(Oi! Some of them are pretty good... — Ed)*, try instead a full desktop PC sans monitor running on a 160W DC converter driving Windows 98, WinAMP and an LCD 16-char x 2-line display... Anyone can have 2000 watts blaring out of their boot, but if it's not MP3 audio, you're not really serious (tongue firmly wedged in side of cheek).

Sounds weird but it is all the rage. There's even a web ring for MP3 car gurus. Point your browser to **www.webring.org/cgi-bin/webring?ring=mp3car;list** for all the details.

I forgot you could crack a walnut with several cases of dynamite...

IF YOU'RE into amateur radio and you're having trouble getting rid of nasty side-tones and carrier frequencies, you might find the solution is as close as your PC.

ChromaSound is a beta software tool that works with your sound card and is in effect a budget audio digital signal processor (DSP). Budget? Ok, so it's free. It uses your sound card to take in audio from your receiver and allows you to create your own filters in real-time as well as remove SSB noise.

It's actually a very nice graphical program that shows you the spectrum analysis of the audio signal. It runs on as little as a Pentium-90, 16MB of memory but requires a full-duplex sound card (which is most of the ones available on the market for the last five years). It runs on anything from Windows 95 up. Well worth a look. Head over to **www.siliconpixels.com/csnd/csnd.htm** for the free download.

I KNOW we've looked at this one before but if you haven't downloaded a copy of Protel's freeware Easytrax CAD package, you're missing out on a simple easy to use but highly functional bit of kit. It comes as two parts — Easyedit for layout and Easyplot for printing.

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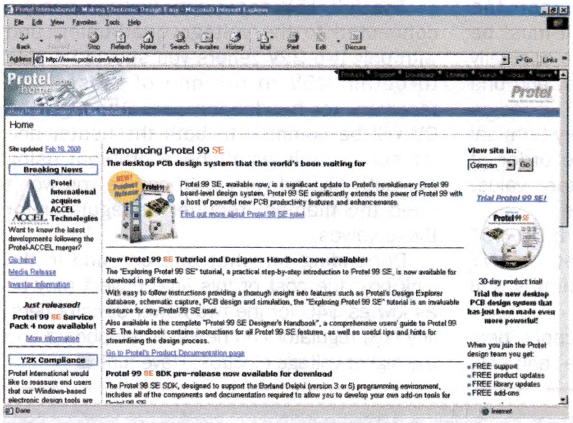
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K118...4 CHANNEL VIDEO SWITCHER KIT...$50
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K120...PLASMA BALL / JACOBS LADDER DISPLAY KIT...$29
K123...ULTRASONIC MOVEMENT DETECTOR KIT...$16
K124...20 -30 SECOND VOICE RECORDER KIT...$19
K125...IR TESTER KIT...$7
K127...12 - 240V AC INVERTER KIT...$35
K127T...12V - 240V AC INVERTER KIT + TORROIDAL TRANSFORMER...$89
K128...SIMPLE PIC PROGRAMMER KIT...$32
K129... PROFESSIONAL PIC PROGRAMMER KIT...$27
K130...HIGH POWER IR RX / TX KIT...$28
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K133...MINI SSC KIT...$55
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K136...CLOCK / CALENDAR KIT...$14
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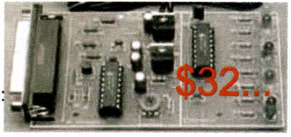
K138...140 LED IR ILLUMINATOR KIT (35 LED VERSION)...$25
K138C...140 LED IR ILLUMINATOR KIT (140 LED VERSION)...$67
K140...PELTIER CONTROLLER KIT...$17
K141...BATTERY MANAGEMENT SYSTEM KIT...$32
K142...CNC STEPPER MOTOR DRIVER KIT (MOSFET VERSION)...$45
K143...MOSFET POWER SUPPLY KIT...$24

FOR MORE DETAILS ON THESE AND MORE KITS SEE OUR WEB SITE

SIMPLE PIC PROGRAMER KIT BARGAIN: (Ref: SC March 1999) Learn to program your own 16F84 / 16F83 / 16C84 micro-controllers the easy way with this simple kit that just plugs into your PC's printer port and uses these small, cheap but powerful chips. Kit includes construction details, PCB and all on-board components, D25 connector and a PIC16F84 IC. The NOPPP software that is required is not inc. but is available on the net. (K128)

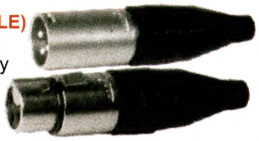


See bellow for cable bargain....

PIC16F84-04P IC: $12 EACH

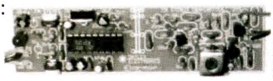
PROFESSIONAL PIC PROGRAMER KIT: This is a kit of parts to use the P16PRO software of Bojan Dobaj to program all 8, 18, 28 & 40 pin DIP serial PIC's. Parallel programmed PIC's - 16C5X are not supported by this programmer. The P16PRO software will work under DOS, WIN 3.1 or WIN 95/98. Do not confuse these programming methods with the serial port and parallel ports of a PC. The software needs to be downloaded from the internet & registered for a small fee from **Oatley Website.** We supply 8, 18 & 40 pin IC sockets. Quick & easy construction. PIC chips are not included. **These are the PIC's that this kit will program:** I2C5XX, I6C67X, I2CE67X, 14000, I6C61, 715, 62, 62A, R62, 63, 64, 64A, R64, I6C65, 65A, 66, 67, 620, 621, 622, 710, 71, 711, 72, 73, PICI6C73A, 74, 74A, 76, 77, F83, R83, 84, F84, R84, PICI6C923, 924, 642, 662. For 64 pin PIC's - 16C92x & 17Cxxx - you will need an adaptor from Microchip or make your own. (K129) $27...Just add $10 for a DB25 cable (25 pins straight through). Valued at around $40

3 PIN (CANNON STYLE) XLR CONNECTORS:

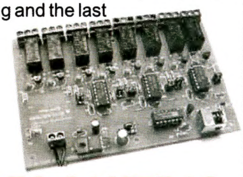


High quality metal body ALCATEL brand Super bargain at $3ea Limited stocks!!!

STEREO FM TRANSMITTER KIT: This kit accepts a stereo line input from any source and will transmit it on the FM Radio band between 88-108MHz. This kit is based around the BA1404 FM modulator IC. The transmitter in this IC is not very stable in terms of frequency so our kit uses our FM Transmitter MKII for the transmitter section. It operates from 6-12V DC and draws 8mA @ 9V. 25 x 65mm PCB size. PCB plus all on-board components, plus battery connector and 2 electret microphones: (K94) $25



8 CHANNEL IR REMOTE CONTROL KIT: This kit converts a Magnavox CD IR remote control, which uses an obsolete coding IC into an IR remote using an SM5021 encoder IC. The receiver uses an IR receiver module tuned to 38KHz. There are 8 relay outputs, 6 are momentary or latching and the last 2 are latching only. The PCB and all on-board components inc. eight output relays are supplied to build both transmitter and receiver kits: (K065RT) $50

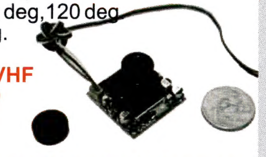


HOUSED VIDEO CAMERAS

CCD B/W IN SWIVEL CASE $99

PCB VIDEO CAMERAS

B/W CCD CAMERAS $89
pinhole (60deg.), 92 deg,120 deg
add $10 for 150 deg.



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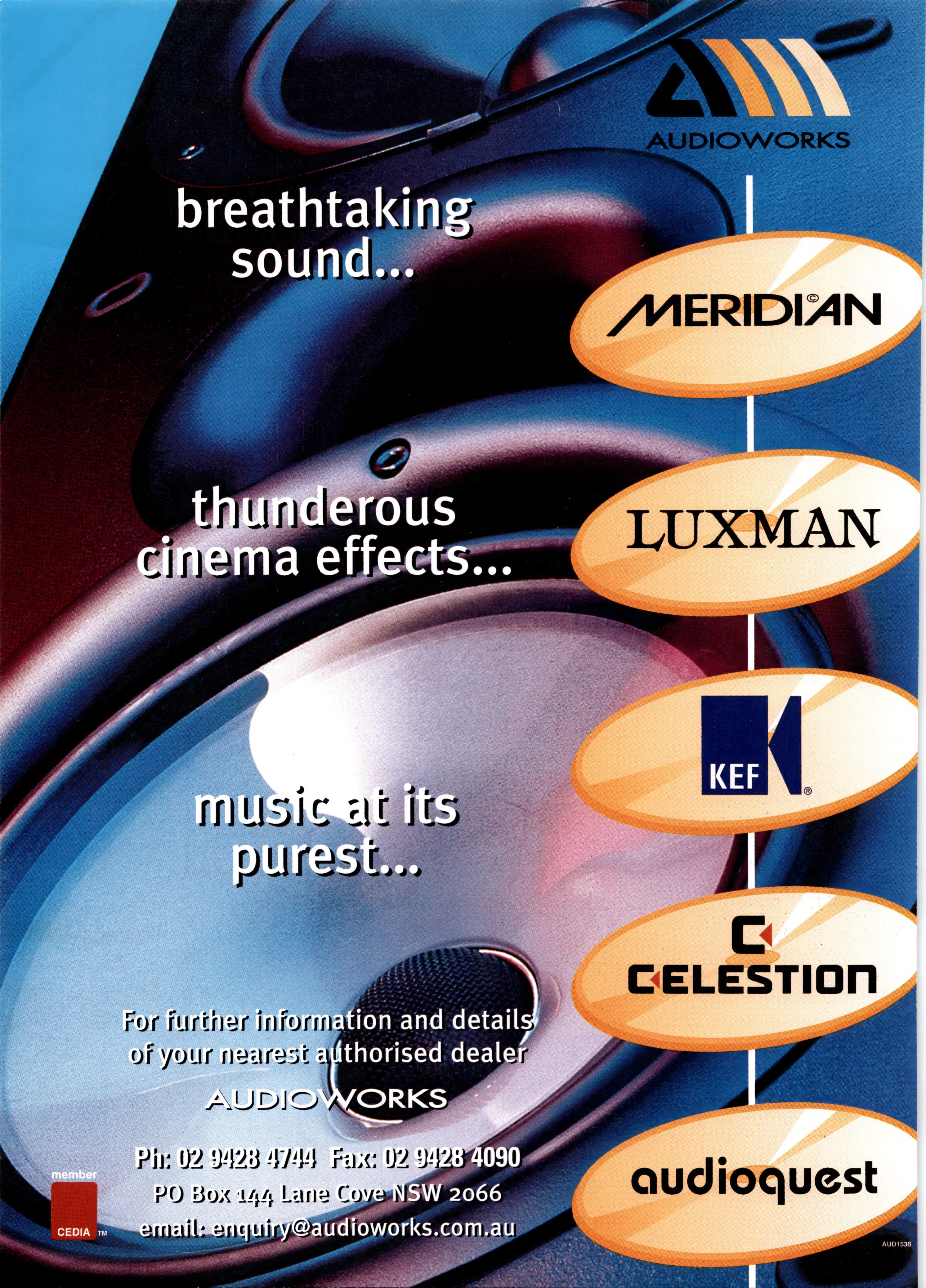

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